

RESEARCH JOURNAL

EDITED BY THE AMERICAN ASSOCIATION FOR
THE STUDY OF PHYSICAL EDUCATION AND RECREATION

MARCH, 1944

VOLUME 15
NUMBER 1

The Research Quarterly

of the American Association for Health, Physical Education, and Recreation

MARY WIBEL, *Acting Editor*

VOLUME 15

MARCH, 1944

NUMBER 1

Contents

	Page
A Study of Mortality Among the Men Who Have Played in the Indiana State Final Basketball Tournaments. <i>Mark C. Wakefield</i>	2
Army Air Forces Physical Fitness Research Program Headquarters, Army Air Forces, Washington, D. C.....	12
The Andover Physical Fitness Testing Program. <i>T. Johnson, Edmund J. Schubert, Montville E. Peck, and J. Roswell Gallagher</i>	16
A Study of the Results of Eight Weeks of Participation in a University Physical Fitness Program for Men. <i>J. W. Kistler</i>	23
A Study of the Distance Traveled by Basketball Players. <i>Lloyd L. Messersmith</i>	29
Individual Differences in Motor Adaptations to Rhythmic Stimuli. <i>Edith C. Haight</i>	38
A Study of Factors Associated with Activity Choices of Participants in Organized Public Recreation Centers. <i>Lewis K. Silverman</i>	44
An Activity Analysis of the Duties of Recreation and Informal Education Leaders and Supervisors. <i>Joe R. Hoffer</i>	50
A Study of the Sit-up Type of Test as a Means of Measuring Strength and Endurance of the Abdominal Muscles. <i>R. T. DeWitt</i>	60
A Comparison of Five Methods Designed to Predict the "Normal" Weight of College Women. <i>Margaret B. Craig</i>	64
Speed Sit-ups. <i>Frank J. Havlicek</i>	75
Research Abstracts. National Council of the Research Section.....	78
State and Section Representatives.....	94
Reprint list.....	95

BOARD OF ASSOCIATE EDITORS

Dorothy Ainsworth
V. S. Blanchard
John Bovard
D. K. Brace
C. L. Brownell
Frederick Cozens
A. Lester Crapser
T. K. Cureton
Leslie W. Irwin

Peter V. Karpovich
C. V. Langton
William R. LaPorte
Leonard A. Larson
Frank S. Lloyd
C. H. McClellan
C. M. Miles
Gertrude E. Moulton
Jay B. Nash

D. Oberteuffer
W. W. Patty
Harry A. Scott
J. R. Sharman
G. T. Stafford
A. H. Steinhaus
Alden W. Thompson
W. W. Tuttle
Jesse F. Williams

Published in March, May, October, and December by the American Association for Health, Physical Education, and Recreation, 1201 Sixteenth Street, N.W., Washington 6, D. C. Subscription, \$3.00 per year; single copies, \$1.00.

Send subscription to: 1201 Sixteenth Street, N.W., Washington, D. C.

Editorial and Advertising Office: 1201 Sixteenth Street, N.W., Washington, D. C. Advertising rates on application.

Entered as second-class matter at the Post Office at Washington, D. C., under the act of March 3, 1879.

610.5
A5
P578
E3

A Study of Mortality Among the Men Who Have Played in the Indiana High School State Final Basketball Tournaments

By MARK C. WAKEFIELD, ED. D.
Evansville Public Schools
Evansville, Indiana

INTRODUCTION

BASKETBALL has had an unusual growth. It is now played by boys of high school age more than any other game. In Indiana its popularity has been so great that Indiana high school basketball has attracted nation-wide attention. The reactions to this situation have not always been favorable.

Numerous limitations have been put upon the game by the national basketball rules committees as well as by state athletic associations. Many of these restrictions have been made in the interests of the health of the players. However, many people believe that basketball is still the most strenuous of high school sports and the one most likely to result in permanent harm to the players.

Due to the popularity of basketball among the youth of many nations and in consideration of the great significance attached to the game by youth and adults, it is important to know whether there is reason to believe that basketball is undermining the health and shortening the lives of the boys who play.

PURPOSE

It is the purpose of this investigation to study mortality among the men who played in the Indiana high school state final basketball tournaments from 1911 to 1935; to find whether this group of men who have played strenuous basketball while in high school compares favorably or unfavorably in death rate with men in the general population, and whether or not the causes of death among the basketball players are such as might reasonably be attributed to basketball playing.

The study should show whether:

1. The ratio of actual to expected deaths is favorable or unfavorable to the basketball players.
2. The number of deaths from causes commonly attributed to athletics is favorable or unfavorable to the basketball group.
3. Age at the time of playing is or is not an important factor in the mortality of the group studied.

AN abstract of a thesis submitted in partial fulfillment of the degree of Ed. D. at Indiana University.

OK.

Medical
Direct
10-28-46
56602
v.15, no.1

A STUDY OF MORTALITY

3

4. Men who played three games on the final day do or do not differ in death rate from other basketball players, or from the general population.

5. Emphasis by schools as indicated by frequency of appearance in the tournaments does or does not affect the death rate of basketball players.

6. The number of years played by men in the state tournaments is or is not a factor in the death rate of basketball players.

7. Men who were regulars do or do not show a death rate differing from substitutes who did not play or who participated only a limited amount of time.

STATEMENT OF THE PROBLEM

The problem is (1) to determine the deaths among men who have played in the tournaments and compare these with the deaths among men in the general population as indicated by appropriate and accepted life tables; (2) to compare with respect to death rates and causes of death groups subjected to different amounts, degrees, and conditions of basketball playing; (3) to learn from reliable sources the causes of death among the basketball group and compare these with tables showing the chief causes of death in Indiana during the period covered by the study.

PROCEDURE

More than 2,900 men who played during the 25-year period from 1911 to 1935 were included in the study. The names and dates of birth of these men were obtained from files of the Indiana High School Athletic Association. Questionnaires were sent to 130 principals of the schools whose teams had participated in the tournaments. Follow-up letters and personal visitations were continued until all questionnaires were returned.

The addresses of all former players were requested as well as the date and place of death of any deceased players. These were tested by the method of random sampling and found to be highly reliable. United States life tables published by the Bureau of the Census were used as ready-made measures with which to compare data. Causes of death were obtained from official sources such as state boards of health, county boards of health, cemetery records, and records of morticians. Tabulation of the data was by means of the International Business Machines punched-card accounting equipment.

When the ages and years of life were known for all basketball players, it was possible to determine the number of expected deaths on the basis of the life tables used (Table I). The number of actual deaths was obtained from the questionnaires. The important factor was the ratio between actual and expected deaths.

Among the 2,919 basketball players there were 123 actual deaths and 181.1 expected deaths. The ratio was 67.9 per cent.

RESEARCH QUARTERLY

AGE	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1911	0	0	11	21	16	11	5												
1912	0	0	3	17	29	19	15	5											
1913	0	1	14	27	45	38	22	15	5										
1914	0	3	8	34	42	59	41	22	15	5									
1915	0	0	12	30	48	52	63	41	22	15	5								
1916	0	2	10	44	48	56	59	63	41*	22	15	5							
1917	0	17	39	84	79	60	58	59*	63	40	22	15	5						
1918	1	9	42	81	108*	95*	64	58	58*	63	40**	22**	15	5					
1919	2	10	45	85	123	123	98	64	58	57	63	38	20	15*	5				
TOTAL	3	42	184	423	538	517	425	327	262	202	145	80	40	20	5				
EXPECTED DEATHS	.008	.12	.60	1.54	2.14	2.19	1.95	1.58	1.31	1.03	.75	.42	.22	.11	.03				
1920	2	24	43	122*	119*	145*	130	98*	64	58	57	63*	38	20	14	5			
1921	1	12	48	78	144*	131	145	130*	97	64	58	57	62*	38	20*	14	5*		
1922	2	6	45	80	113	150	139	145	129	97	64	58	57	61	38	19	14	4	
1923	0	13	32	95	108	125	154*	139	145	129	97	64	58	57	61	38	19	14	4
1924	2	8	46	71	127	115	128	153*	139	145	129*	97	64	58	57	61	38	19	14
1925	0	6	39	97	104	144	120	128	152*	139	145	128*	97*	64	58	57	61	38	19
1926	2	12	31	76	119	120	145	120	128	151*	139	145	127	96	64	58*	57	61	38
1927	0	40	31	77	107	131	123*	145*	120	128	150	139*	145*	127	96*	64	57	57**	61
1928	1	6	34	68	110	116	137	122*	144	120	128*	150	138	144	127	95	64*	57	54
1929	0	6	28	76*	105	120	119	137**	121	144**	120*	127	150	138	144	127	95*	63	57*
TOTAL	10	103	377	840	1156	1297	1340	1317	1239	1175	1087	1028	936	803	679	538	410	313	247
EXPECTED DEATHS	.022	.25	1.01	2.49	3.66	4.31	4.69	4.06	4.77	4.65	4.38	4.20	3.88	3.38	2.90	2.35	1.84	1.43	1.17
1930	1	2	34	83	101*	119	135	121	142**	119	127*	150	138*	144	127*	94	63**		
1931	0	7	34	83	107	113	119	120	119*	135	121	140*	119	126	150	137	144	126	94
1932	2	9	32	85	118	124	120	119	120	118	135	121	139	119	126	150	137*	144	126
1933	1	13	34*	82	118*	134	126*	120	118*	120	118	135	121	139	119	126	150	136	144
1934	4	9	39	87**	119	124	141	125	120	117	120	118*	135*	121**	139**	119	126	150*	136
1935	2	10	38	92	117	128	126	141	125	120	117	120	117	134	119	137	119	126**	149
1936	0	2	10	38	92*	117	128	126*	141	125	120	117	120	117	134	119	137	119*	124
1937	0	0	2	10	38	91*	117	128	125	141	125	120	117	120**	117	134*	119	137	118*
1938	0	0	0	2	10	38*	90	117	128*	125	141	125	120	117	117	117	133	119	137
1939	0	0	0	0	2	10	37	90	117	127	125	141	125	120	117	117	117	133	119*
1940	0	0	0	0	0	2	10	37	90	117	127	125	141	125	120*	117	117*	117	133
TOTAL	10	52	223	562	822	1000	1136	1242	1338	1366	1391	1381	1381	1388	1396	1417	1426	1401	1343
EXPECTED DEATHS	.016	.093	.45	1.29	1.97	2.50	3.06	3.47	4.01	4.10	4.17	4.28	4.28	4.30	4.47	4.82	4.99	5.05	5.11
Actual	0	0	1	5	6	4	5	10	6	3	7	7	5	6	6	2	6	7	5
POB	.045	.460	2.06	5.32	7.78	8.99	9.70	9.92	10.09	9.78	9.30	8.81	8.37	7.78	7.39	7.17	6.83	6.48	6.25

* DEATH

TABLE I. Actual and Expected Deaths Among All Basketball Players From 1911 to 1940

Several groups of basketball players who were known or assumed to have been subjected to different amounts, degrees, or conditions of playing were studied:

1. 784 men who were 14, 15, or 16 years of age at the time of playing were compared with 1,093 men who were 18, 19, or 20 years old when they played.

2. 365 men who played from 1911 to 1916 were studied. During this period it was assumed that basketball was played under conditions unfavorable to health outcomes.

A STUDY OF MORTALITY

5

32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	TOTAL DEATHS	
																		0	.25
																		0	.36
																		0	.69
																		0	.97
																		0	1.26
																		1	1.62
																		1	2.34
																		7	2.91
																		1	3.45
																		10	
																			13.9
																		5	3.50
																		5	3.95
																		0	4.45
4																		1	5.00
14	4																	2	5.54
19	14	4																3	6.15
38	19	14	4															2	6.67
61	38	19	14	4														9	6.98
54	61	38	19	14	3													5	7.79
57	54	60	37	19	14	3												9	8.29
247	190	135	74	37	17	3												41	
1.17	.95	.71	.42	.21	.101	.013													58.6
63	56	53	60	37	19	14	3											10	6.94
94	61	56	53	60	37	19	14	3										6	7.45
26	94	61	55	52	59	37	19	13	3									2	8.06
44	126	94	61	55	52	59	37	19	13	3								8	8.70
36	144	124	94	61	55	52	59	36	19	13	2							11	9.38
49	136	144	123	94	61	55	52	59	36	19	13	2						6	10.08
24	149	136	143	123	94	61	55	51	59	36	19	11	2					3	10.53
18	124	149	136	143	123	94	61	55	51	59	36	19	11	2				8	11.22
37	117	123	149	136	142	123	94	61	55	51	59	36	19	11	2			5	11.54
19	137	117	123	148	135	142	123	94	61	55	51	58	36	19	11	2		7	12.09
33	118	137	117	122	147	135	141	123	94	61	55	50	58	36	18	10	2	6	12.67
343	1262	1194	1114	1031	924	791	658	514	391	297	235	176	126	68	31	12	2	72	
5.11	5.05	5.13	5.12	4.95	4.72	4.28	3.75	3.14	2.54	2.05	1.74	1.41	1.08	.632	.300	.129	.023		108.5
5	5	4	3	5	0	1	3	0	0	2	4	0	2	1	2	0	0	123	
5.25	6.00	5.85	5.54	5.17	4.82	4.29	3.75	3.14	2.54	2.06	1.74	1.42	1.08	.632	.300	.130	.012		181.1

3. 379 men who played three games in one day in the tournaments were studied.

4. Comparisons were made between 1,195 substitutes and 1,359 regulars who played from 1917 to 1935.

5. 780 men from large schools assumed to have placed great emphasis upon basketball were studied.

6. 499 men from small schools assumed to have placed unusual stress upon the game were studied.

Among 123 basketball players who died between March, 1911, and March, 1941, the principal causes of death were (1) external violence 34.1 per cent; (2) cardiovascular-renal diseases 16.3 per cent; (3) tuberculosis, all kinds, 13.8 per cent; (4) pneumonia and

influenza 10.6 per cent. When compared with deaths from the same causes among men in Indiana who were of the same age and who lived at the same time the results were favorable to the basketball group with respect to tuberculosis, pneumonia, and influenza. The results were slightly unfavorable with respect to the cardiovascular-renal diseases and very unfavorable with respect to deaths from external causes. One death in three among basketball players was due to external violence.

CONCLUSIONS

This investigation has been an attempt to study mortality among the men who have played in the Indiana high school state final basketball tournaments to determine (1) whether the death rate among the basketball players compares favorably or unfavorably with men in the general population, (2) whether men who have played basketball under different conditions show corresponding variations in their death rates, and (3) whether the causes of death among basketball players are such as might reasonably be attributed to basketball playing.

The subjects used in this study were men who played in the Indiana high school state final basketball tournaments from 1911 to 1935. The State of Indiana has long been considered the center of high school basketball. The state final tournaments, in which there were usually sixteen teams, represent the peak of the high school basketball program.

All men who were entered in the final sixteen-team tournaments were included in the study provided they could be located or their status determined. When all available information was in there were 2,919 men upon whom to base the study.

Mortality rates used were from United States Life Tables published by the United States Bureau of the Census and based upon total registration areas as of the date when the census was taken.

The data used were partly documentary and partly of the questionnaire type. The documentary data were taken from bound copies of newspapers and from the permanent files of the Indiana High School Athletic Association. Questionnaires were sent to principals or coaches of schools whose teams had played in the tournaments. The data obtained from school officials were tested by the method of random sampling and were found to be highly reliable. The causes of death were determined in all cases except one. Ninety-five per cent of the causes were obtained from official records. All the data were collected and compiled by the author. The International Business Machines punched-card accounting equipment was used in sorting the data. The punching and sorting were done by experts. The art work on the principal figures and tables was done by a professional commercial artist.

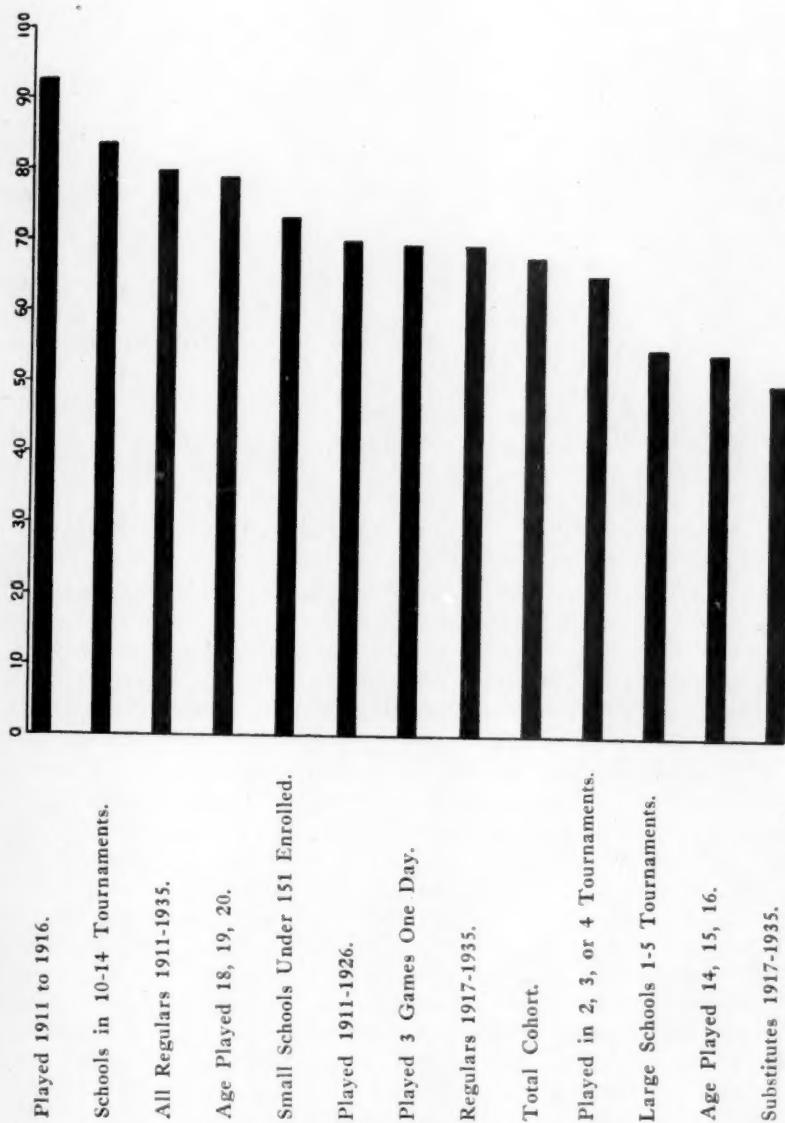


FIG. 1. Ratio of actual to expected deaths among all basketball groups compared.

The first question to be answered was whether the death rate among basketball players compares favorably or unfavorably with that of men in the general population. A table was constructed whereby it was possible to determine the number of basketball players at each age level during each year covered by the study. The

prevailing life tables indicated the number of deaths per 1,000 alive in the general population at any age during the period covered by the table. It was possible then to determine the number of expected deaths among the basketball group. The number of actual deaths among the basketball players was determined from the questionnaires. The total expected deaths among the basketball group was 181.1. The number of actual deaths was 123. The ratio of actual to expected deaths was 67.9 per cent. This indicated an advantage in favor of the basketball group of 32.1 per cent. When corrections were made for the unusual death expectancy in 1918 and for the lowered expectancy in the East North Central States during the last decade, the results were still in favor of the basketball group by not less than 30 per cent.

In regard to the first question then, the evidence set forth in this study indicates that, when deaths among the men who played in the Indiana high school state final basketball tournaments are compared with those among men in the general population who were of the same age and lived at the same time, the results show a situation quite favorable to the basketball players.

The death rate among the basketball players was equivalent to the rate that would prevail in the general population if the average life expectancy were 70 years. According to excellent authority, a life expectancy of 70 years represents the ultimate attainable in the United States with our present knowledge of medical and sanitary science.

The second question was whether men who played basketball under different conditions showed corresponding variation in death rates. Various groups of basketball players were selected who were known or assumed to have been subjected to different amounts, degrees, or conditions of basketball playing. These groups were compared first with the general population by the same means as that indicated for the total group of basketball players. The ratio between actual and expected deaths was determined for each group. These ratios then were compared, a high percentage indicating an unfavorable situation and a low percentage a favorable situation for the group (Fig. 1). With respect to age at the time of playing, the ratio of actual to expected deaths for the young players (14, 15, and 16) was 54.2 per cent. The ratio for the older group (18, 19, and 20) was 78.9 per cent. Therefore, on the basis of the evidence presented in this study, it would seem that the mortality situation was more favorable to the younger than to the older players.

The men who played from 1911 to 1916 presented the least favorable situation of all groups studied, the ratio of actual to expected deaths being 92.9 per cent as compared with 67.9 per cent for the entire cohort of basketball players. The fact that 306 of

these men were regulars and only 59 were substitutes may have influenced these results. On the basis of all the evidence, however, it appears that basketball playing in the early days did considerable harm as indicated by the unfavorable mortality situation presented by this group.

The study of men playing before and after January, 1927, was intended to reveal whether or not the required medical examination brought about any change in death rate. There was considerable improvement after 1927 as compared with the period from 1911 to 1926. Most of the improvement, however, was between 1917 and 1926 and could not therefore be attributed to the results of the medical examination. It seems probable that the marked improvement after 1917 was due to generally improved conditions with respect to the control of basketball playing in Indiana.

The question as to whether men who played three games in one day were damaged by this playing was considered. Among 379 men who played three games in one day, there were 17 actual and 24.5 expected deaths. This was a ratio of 69.4 per cent as compared with 67.9 per cent for the entire group. This difference was so slight that it pointed to the conclusion that the men who played three games in one day presented a mortality situation comparable with other basketball players with an advantage of 30 per cent over men in the general population.

Two groups of basketball players were assumed to have played under conditions indicating a great deal of emphasis by schools and communities. These were men from small schools placing teams in the final tournaments and men from large schools placing teams in the final tournaments 10-14 times.

Among the men from schools placing teams in the tournaments 10-14 times, the ratio of actual to expected deaths was 83.8 per cent. This seemed unfavorable as compared with other groups and with the total cohort. Examination of all the facts revealed that 13 of the 40 deaths among this group of men were due to external causes. When deaths due to diseases alone were considered, the ratio was 68 per cent.

Analysis of the statistics regarding the men from small schools revealed that 13 of the 28 deaths were due to external causes. When deaths due to diseases alone were considered, the ratio of actual to expected deaths was 47 per cent. The conclusion was that the apparently unfavorable picture presented by these groups is due to deaths from external causes which could hardly result from harmful effects of basketball playing.

Men who played in more than one tournament were compared with men who played in only one tournament. There were 528 men who came back the second, third, or fourth time. Among this group

were 23 actual deaths and 35.59 expected deaths. The ratio was 64.6 per cent as compared with 68.7 per cent for men who played in only one tournament. The conclusion was that the number of tournaments played by individual players did not affect the death rate of the men included in this study.

When all regulars were studied along with all substitutes, a ratio of 79.4 per cent was found for regulars and 49.3 per cent for substitutes. When regulars and substitutes playing from 1917 to 1935 were compared, the ratio was 50.4 per cent for substitutes and 69.1 per cent for regulars. Forty-seven per cent of the deaths among substitutes and 34 per cent of the deaths among regulars were due to external causes. On the basis of the evidence presented in this study, the mortality situation among men who were substitutes was found to be more favorable than that found among men who were regulars.

The third question to be answered is whether the causes of death among the basketball players are such that they could reasonably be attributed to basketball playing.

The causes of death among the 123 men who were deceased were reliably determined. All causes of death were classified under five principal headings. The deaths were tabulated and the number of deaths from each principal cause was determined as well as the per cent of total deaths. The results were compared with the per cent of deaths from the same causes among men in Indiana within approximately the same age range as that represented by the basketball players.

The most significant cause of death among basketball players was external violence. Thirty-four per cent of all deaths were due to accidents or suicide. As compared with 17.3 per cent for the state of Indiana, this represents a very high accidental death rate for the basketball players. On the other hand, from the standpoint of the possible deleterious effects of basketball with respect to health and consequent longevity, it greatly strengthens the position of the defense. It leaves a ratio not greater than 50 per cent between actual and expected deaths from diseases of all kinds. So it may be stated that when deaths among basketball players and general population are compared, considering all causes that could by any possibility be attributed to basketball playing, the results of this study present a condition very favorable to the basketball players.

There were 17 deaths among the basketball group due to tuberculosis. This represents 13.8 per cent of all deaths. Among the men in Indiana from 1911 to 1940 of approximately equivalent ages, 20.9 per cent of all deaths were due to tuberculosis.

If deaths due to external causes are excluded, then 21 per cent

of the deaths among basketball players from all diseases were due to tuberculosis. In the equivalent population of Indiana 25.3 per cent of all deaths, excluding external causes, were due to tuberculosis. The evidence from this study then would indicate that the situation with respect to deaths from tuberculosis was not unfavorable to the basketball players.

The cardiovascular-renal diseases were responsible for 20 deaths among the basketball group which represented 16.3 per cent of all the deaths. In the Indiana group of equivalent ages from 1911 to 1940, 13.3 per cent of all deaths resulted from the same causes. If deaths due to diseases alone are considered, 25 per cent of the basketball deaths were due to cardiovascular-renal diseases. About 16 per cent of all deaths in the Indiana group from diseases were due to these causes. The conclusion was that on the basis of the evidence presented in this study the number of deaths from the cardiovascular-renal diseases was greater than should have been expected among the basketball players and some of these deaths presumably resulted from the basketball playing.

Thirteen deaths resulted from pneumonia and influenza. This represented 10.5 per cent of all deaths. Among the Indiana population with which basketball players were compared, 11.4 per cent of all deaths were due to these diseases. The conclusion was that on the basis of this study the evidence does not indicate that basketball players show any unusual tendency to succumb to pneumonia or influenza.

The Army Air Forces Physical Fitness Research Program

BY THE

*Headquarters, Army Air Forces
Washington, D. C.*

PHYSICAL fitness research is conducted in the AAF for the purpose of improving methods and techniques for the development and measurement of the physical fitness of AAF personnel. Data are procured on pertinent physical fitness problems through the application of the AAF Physical Fitness Test* and the conduct of research projects.** Results of the testing and research programs have implications for the quality and quantity of personnel, the nature and scope of the physical activities program, the kind and amount of equipment and facilities, and for the time necessary for the program.

ORGANIZATION AND ADMINISTRATION

Research projects are proposed by the office, Assistant Chief of Air Staff, Personnel, and the office, Assistant Chief of Air Staff, Training, as well as any AAF field activity. These projects are submitted to Headquarters, AAF, for approval. All projects are coordinated between AC/AS, Training, and AC/AS, Personnel, and the Air Surgeon. If approved they are submitted to the School of Aviation Medicine for accomplishment.

The School of Aviation Medicine is delegated the following responsibilities: (1) supervision of all approved AAF physical fitness research, (2) statistical analysis of physical fitness research data, (3) preparation and submission of physical fitness research reports to Headquarters, AAF, and (4) coordination with Commands and Air Forces within which the approved physical fitness research is to be conducted.

RESEARCH PROGRAM

The AAF physical fitness research program is designed to solve problems having immediate implications to the physical fitness program. The phases of research and particular problems are:

1. Program: The evaluation of
 - a. Activities in the development of physical fitness—calisthenics, group running, obstacle course, aquatics, and sports.
 - b. Combination of activities in the one-hour required program.

* AAF Regulation No. 50-10, *Training—Physical Fitness Test*, 28, April 1943.

** AAF Memorandum No. 80-10, *Administration Practices—Physical Fitness Research*, 26 January 1944.

c. Personnel, equipment, and facilities necessary to achieve a desired state of physical fitness in AAF personnel.

d. Administrative procedures and conduct of the AAF Physical Fitness Program.

2. Tests and Measurements:

a. Selection and evaluation of tests and test items for the measurement of physical fitness.

b. Evaluation of administrative procedures on the conduct of the AAF Physical Fitness Test.

c. Determination of the relationship between the AAF Physical Fitness Test and other similar tests and procedures.

3. Physical Characteristics of AAF Personnel:

a. Determination of physical fitness standards for chronological age groups.

b. Determination of the rate and capacity for the development of physical fitness according to chronological age with respect to:

(1) Constituent phases of physical fitness.

(2) Each activity in AAF Physical Fitness Program.

c. Relationship of physical fitness (performance fitness) to body build, nutritional status, and circulatory-respiratory status.

4. Effects of Training:

a. Determination of the effects of training according to:

(1) Chronological age.

(2) Time for period.

(3) Stage of training.

(4) Activities in the program.

b. Determination of the degree of retrogression in physical fitness due to illness, and the determination of the time necessary for the recovery of the original state of physical fitness.

c. Determination of the program time necessary for the *development* of a desired state of physical fitness and the time necessary for the maintenance of physical fitness.

RESEARCH RESULTS

Test results and special research projects on AAF personnel at various stages of training and operations have indicated*:

a. There is a gradual but steady decline in the state of physical fitness (of personnel entering the AAF) from the age of 18 to the age of 45. The total cumulative loss over this age span is 45 per cent.

b. When comparing physical education personnel in the Army Air Forces with non-physical education personnel, over the same age span (21 to 36) two results are evident:

(1) The physical education population is found to be 63 per

*The AAF Physical Fitness Test was used as the experimental basis for projects herein reported. This test consisted of an Index Score determined by performances on sit-ups, chinning, and 300-yard shuttle-run.

cent superior in physical fitness.

(2) The amount of retrogression in physical fitness with increase in age is less in the physical education population (18 per cent) than the non-physical education population (30 per cent).

c. It is found that the length of time of participation is not an index of physical fitness improvement. No evidence is yet available to indicate when the capacity limits for physical fitness development are reached, or when training becomes one of maintenance of physical fitness rather than development.

d. When comparing the state of physical fitness with certain aspects of the medical examination, the following results are found:

(1) A moderately significant relationship is found between the state of physical fitness and the difference between chest and abdominal measurements. As the difference increases, (that is, the abdominal measure becomes relatively smaller) a higher state of physical fitness is found. Personnel with a maximum difference are 50 per cent superior in physical fitness.

(2) No relationship is found between the state of physical fitness and medical ratings on posture (rated as excellent, good, fair, and bad).

(3) A slightly significant relationship is found between the state of physical fitness and ratings on figure. The trend toward the slender figure is positively related to physical fitness.

(4) A slightly significant relationship is found between the state of physical fitness and ratings on frame (rated as light, medium, and heavy). The trend toward the light is positively related to physical fitness.

(5) No relationship is found between the state of physical fitness and cardiovascular-respiratory ratings, namely: character of pulse, systolic pressure, diastolic pressure, sitting normal pulse rate, pulse rate immediately after exercise, and pulse rate two minutes after exercise.

(6) A positive and moderately significant relationship is found between the state of physical fitness and the General Classification Test Score. The trend toward the higher G.C.T.S. is positively related to the state of physical fitness. The most superior individuals are 33 per cent superior in physical fitness as compared to the most inferior.

e. It is found that chinning performances using the reverse grasp of the bar are superior to performances using the forward grasp. The difference becomes greater with increase in the level of performance; the difference ranging from two to three for chinning performances from one to twenty.

IMPLICATIONS OF RESEARCH

1. The results in the improvement of physical fitness are in

proportion to the practice of the following principles:

a. Participation must be intense. Personnel must be motivated to go "all-out" when participating.

b. Participation must be frequent. Daily activity is highly desirable. It is necessary if rapid improvement is desired.

c. Participation must be of sufficient duration to approach physical fatigue.

d. The activities selected for the program must demand vigorous effort in performance.

e. Activities must be graded and graduated according to chronological age and state of physical fitness. In the age groups found in the AAF on the adult level, the time required for the achievement of physical fitness increases with age.

f. Participation in the Physical Fitness Program must be supplemented by good health practices.

2. When administering the chinning test either the forward or reverse grasp should be used. They should not be used interchangeably.

3. The AAF Physical Fitness Test, or similar performance test, is considered a supplement to the medical examination. Participation in physical fitness tests should follow a satisfactory medical examination.

The Andover Physical Fitness Testing Program

By

T. JOHN JOHNSON, EDMUND J. SCHUBERT, MONTVILLE E. PECK
and J. ROSWELL GALLAGHER
*Phillips Academy
Andover, Mass.*

THE estimation and improvement of the physical fitness of youths have rapidly become an important part of every secondary-school program, and in an effort to make such an examination more efficient, many new tests and methods have been devised. This report briefly describes a group of procedures found valuable in the determination of the various aspects of boys' physical fitness, and emphasizes some motor skills tests which estimate the degree of skill boys have in their performance of a few important activities. It seems particularly wise in these days to make a testing program as brief and yet as helpful as possible. The emphasis in our fitness program has been upon conditioning and training rather than testing, but by making our motor skills testing procedures efficient, we feel we have justified their retention. Under present conditions when the institution of body-building as an adjunct to athletics is widespread, it is proper to consider revising the content of motor skills fitness tests and to include in them only a few of those activities which are not being given special attention in the training program. The employment of a large number of skills tests involving many activities which subsequently would be carried out in a conditioning program regardless of the test results appears to us to be inefficient.

MEDICAL FITNESS

Medical fitness is basic, and should be determined by a careful health examination.^{1*} That such an examination is desirable even for privileged preparatory school boys is evident from the data presented in Table I, which also lists the incidence of some findings made at the selective service examination of young men in the 18-19 year age group.^{1,2,3} The discovery and subsequent correction of many of these conditions can do much to raise the level of this aspect of the fitness of youth.

FUNCTIONAL FITNESS

Dynamic or functional fitness is also important. It is well to know

* Superior figures refer to numbered bibliography at end of article.

TABLE I

Leading Causes of Rejection 18-19
Year Old White Registrants

	Per Cent		Per Cent
Eye	4.8	Vision needing Correction	15.3
Ear	1.6	Color Vision Deficient	5.3
Hernia	1.5	Hearing Impaired	1.7
Underweight	0.8	Rheumatic Heart Disease	0.7
Tuberculosis	0.7	Hernia, Hydrocele, and	
Cardiovascular	1.5	Undescended Testes	1.0
Musculo-skeletal	2.3	Musculo-skeletal	1.3
		Diabetes	0.2
		Dental Caries	70.0

NOTE: The standards used in these two sets of examinations differ considerably and one set of figures should not be compared with the other. The lists have been abbreviated considerably and the original articles should be consulted.

how efficiently each boy's heart and lungs respond to strenuous exercise so that the amount of conditioning each requires and the effects of any conditioning program can be determined. The Step Test technique^{4, 4a} is a simple and reliable means of testing this aspect of fitness. The data in Table II clearly show the variation in this aspect of fitness which obtains in a group of healthy boys, and also indicate the improvement in functional fitness following a ten weeks' program of body-building exercises^{5, 6} and athletics. Although there are fewer low scores, a higher general average, and more high scores at the end of the conditioning program, it is evident, however, that there is still a wide range of functional fitness within the group. Even if every boy worked equally hard, there would still be this variation in fitness indices because of the constitutional differences in the quality of each boy's heart and lungs. Some have excellent heart and lungs and reach a high level of fitness with little effort; others work very hard but because of organic differences cannot achieve an equal state of fitness.

MOTOR SKILLS FITNESS

The ability to perform certain activities which require coordination, strength, and skill is also important, and it is desirable to test and subsequently to attempt to teach or improve them. Cureton⁷ has recently described a group of such motor skills tests, and has quite properly emphasized the desirability of teaching these skills. In an effort to obtain the maximum amount of information in the minimum amount of testing time, we have recently used a small group of skills tests with considerable success. Each test in the group has been selected because it represented a skill which might conceivably be of some use to the individual, and an effort has been made to avoid tests which involved the use of the same muscle groups required for the proper performance of other tests. The introduction of a half-hour body-building period four times a week into our

TABLE II

DISTRIBUTION OF FITNESS INDICES BEFORE AND AFTER A TEN-WEEK
CONDITIONING PROGRAM

Fitness Indices (Step Test)	Distribution of Fitness Indices at Initial Test	Distribution of Fitness Indices after a Ten Weeks' Body-Building and Athletic Program
20-24	0	
25-29	2	
30-34	0	
35-39	1	
40-44	0	
45-49	2	1
50-54	13	1
55-59	61	17
60-64	110	57
65-69	145	92
70-74	101	116
75-79	55	98
80-84	13	50
85-89	9	36
90-94	10	17
95-99	1	15
100-104		11
105-109		6
110-114		4
115-119		2

program has obviated the necessity of giving many tests which formerly would have been used. It seems inefficient to test boys at push-ups and running if these activities are going to be carried out by all boys at each body-building session regardless of the test results, or to test abdominal strength if the abdominal muscles are to be given special attention in that program. Swimming has been given a place of particular importance in these tests because of the general belief in the value of this skill. It is obvious that many other tests might well be included or that different tests might be substituted for the ones chosen. This group of tests is presented only as representing a procedure which has been found efficient and satisfactory under the conditions which obtain in this institution at the present time. Much can be learned in regard to an individual's coordination during the performance of these and other tests (and also incidentally from his performance during his step test which may be noted even though it is not recorded as part of his score.

To complete the skills test data a notation might well be made regarding the individual's ability to play adequately such games as golf, tennis, squash, and handball; each is of particular significance because of their carry-over value. It is a proper function of a physical education program to supply at the secondary-school level instruction in one or more games which can be played later in life.

THE MOTOR SKILLS TESTS*

The Vertical Jump.—The subject stands erect with feet flat and toes touching a smooth wall. The highest point to which he can reach and make a chalk mark is recorded. The highest point he can mark during a standing vertical jump is then noted and the difference in inches between the two marks is recorded.

Rope Climb.—A rope of 21 feet in length is used. A hand-over-hand style without using feet or legs is required and no time limit is set. Scores are given in terms of whether the subject reached 9, 12, 15, 18, or 21 feet.

The Standing Broad Jump.—The distance of a conventional standing broad jump is recorded as being less than five feet, 5'6", 6', 6'6", etc.

The Fence Vault.—Five horizontal bars $3\frac{1}{2}$, 4, $4\frac{1}{2}$, 5, and $5\frac{1}{2}$ feet from the floor are to be vaulted in turn. Not all the boys need attempt the two higher bars, and only the large ones, the $5\frac{1}{2}$ foot bar. The highest bar successfully vaulted is recorded.

Swimming.—Each candidate is required to dive in, demonstrate his ability to swim the back stroke, breast stroke, side stroke, and free style, and to swim 100 yards using any one or combination of strokes. The quality of each of the four parts of this test is graded from 0 to 5, a rating of "0" meaning no ability whatever and of "1" to "2" unsatisfactory ability and requiring instruction. Observers seldom disagree in this subjective rating method.

In all such tests the question of the relationships between age, height, weight, and performance arises, and it is necessary to decide what allowances shall be made in the scoring for younger or smaller boys. In the case of the swimming tests no allowance seems necessary; a small or young boy can perform the skills we require, no time element is involved, and if he cannot properly do each part of the test he should be taught to do so. In the performance of the other skills tests, however, age, weight and height are factors, and that some adjustment should be made for them in grading scores is so well recognized that it hardly need be discussed.⁸ One or two bits of data from our tests clearly illustrate this point: almost 50 per cent of our largest boys broad jump over 7 feet, while less than 1 per cent of our smaller boys do so; about 30 per cent of our largest boys rope climb 18 feet or more, while only 10 per cent of the smaller ones reach that height. However, any method of correcting these factors can only be approximate and must be easy to administer. A modification of the classification plan described by Cozens, *et al.*,⁸ has been found efficient. Table III furnishes a quick method of

* For more complete instructions and many valuable suggestions, see Reference 8.

obtaining the sum of height and weight exponents. This sum is added to the product of twice the boy's age at last birthday and the result is referred to Table IV to determine the boy's classification. A Roman numeral classification is used to avoid confusion with capital letter test scores.

TABLE III

A TABLE FOR THE RAPID CALCULATION OF HEIGHT-WEIGHT EXPONENTS
Height (inches)

Weight (Pounds)	47" or less	48"	50	52	54	56	58	60	62	64	66	68	70	72	74	76 or more
90 or less	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
91	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
97	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
104	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
110	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
116	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
122	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
129	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58
135	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
141	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
147	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61
154	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
160	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
166	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
172	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65
179	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
185	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
191 or more	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68

Add $2 \times$ age (i.e., for 16 yrs. add 32; 18 yrs. add 36, etc.) to the sum of the height-weight exponents and refer this total sum to Table IV in order to obtain a boy's classification. Example: A boy who is 16 yrs. old, 68" tall, and 140 lb. in weight— (2×16) plus 55 = 87, which by reference to Table IV is Group II.

Group IV as we use it has a wide range because few of our students belong in the low height-weight-age group. Group IV may be further divided as suggested by Cozens⁸ into three separate groups.

TABLE IV

A TABLE FOR THE CONVERSION OF HEIGHT-WEIGHT-AGE EXPONENTS
INTO GROUP CLASSIFICATIONS

Group	Sum of Exponents
I	88 and over
II	83-87
III	79-82
IV	78 and below

For the purposes of the examination of those who need instruction in any given skill, only a pass or fail system is necessary, but in order to stimulate interest A (excellent), B, C, D (or fail) ratings are desirable. On the basis of our data and the experience of others, the following scoring tables have been developed. The use of these or similar tables at each station in a testing program permits rapid and reasonably equitable scoring.

TABLE V
SCORING SCHEDULE FOR THE ROPE CLIMB. DISTANCE CLIMBED (FEET)

Classification Group	Distance less than 12 ft.	12 ft.	15 ft.	18 ft.	21 ft.
I	D	D	C	B	A
II	D	D	C	B	A
III	D	C	B	A	A
IV	D	C	B	A	A

TABLE VI
SCORING SCHEDULE FOR THE BROAD JUMP
Distance Jumped (Feet and Inches)

Classification Group	Less than 5'0"	5'6"	6'0"	6'6"	7'0"	7'6"	8'0"	8'6"	9'0" or more
I	D	D	C	C	C	C	B	B	A
II	D	D	C	C	C	B	B	A	A
III	D	C	C	C	C	B	B	A	A
IV	D	C	C	B	B	A	A	A	A

TABLE VII
SCORING SCHEDULE FOR THE FENCE VAULT
HEIGHT OF HIGHEST BAR VAULTED

Classification Group	Less than 3½ ft.	3½ ft.	4 ft.	4½ ft.	5 ft.	5½ ft.
I	D	D	C	C	B	A
II	D	D	C	C	B	A
III	D	C	C	B	A	
IV	D	C	B	A		

NOTE: Only Groups I and II and III need attempt the five-foot bar, and only Groups I and II the 5½ foot one.

TABLE VIII
SCORING SCHEDULE FOR THE VERTICAL JUMP

Classification Group	Less than 12 in.	12	13	14	15	16	17	18	19	20	21	22	23	23 More than
I	D	D	D	C	C	C	C	C	C	B	B	B	A	A
II	D	D	D	C	C	C	C	C	B	B	B	A	A	A
III	D	D	C	C	C	C	C	B	B	B	A	A	A	A
IV	D	C	C	C	C	C	B	B	B	A	A	A	A	A

RESULTS

Cureton⁷ has recently published data which emphasize the need for swimming instruction in the general population. He found that 13 per cent of Illinois students were unable to swim at all. Kiphuth's⁹ data are more similar to our findings. In the five years from 1936-1941 94.5 per cent of the 4,163 freshmen at Yale were found to be able to swim 100 yards; only 1.7 per cent could not swim at all. At Andover 1.6 per cent were found in 1943 unable to swim at all; 3.7 per cent could not swim 100 yards, and 35.2 per cent of the entire group needed instruction in some type of swimming in order to bring their performance up to a good grade.

Weakness of the arms is common at this age level, and our highest per cent of failures occurs in the rope climb. About 50 per cent of Groups III and IV failed to climb twelve feet and about the same proportion of Groups I and II failed to reach fifteen feet at

the time these tests were given at the beginning of the school year before the body-building and athletic program had commenced. Our standards for the broad jump are low, but between 10 and 20 per cent failed to pass the requirements. It does not seem profitable to set high standards for this test. Between 10 and 15 per cent failed the fence vault and less than 10 per cent of each classification group failed the vertical jump.

SUMMARY

1. A simple and efficient method of testing motor skills fitness is described. This group of tests, which emphasizes swimming, can be given quickly, scored easily, adjusted to a boy's height, weight, and age, and combines tests which may be of some practical value to the individual and which are not given specific attention in our body-building program. Tests involving muscles or skills which are given special emphasis in our body-building program or athletic program are omitted.

2. Use of this test in conjunction with an adequate health examination and a test of functional fitness should provide a relatively complete answer to the question of an individual's physical fitness.

3. The importance of following these various tests with a program of instruction for those lacking adequate skill or fitness is emphasized.

4. Results obtained from the administration of these tests from a group of preparatory school boys are given.

REFERENCES

1. Gallagher, J. R., *New England J. Med.*, 229, 315, 1943.
2. Rowntree, L. G., *J. Health and Phys. Ed.*, 14, 370, 1943.
3. Rowntree, L. G., K. H. McGill and T. I. Edwards, *J. Am. Med. Assn.*, 123, 181, 1943.
4. Gallagher, J. R., and L. Brouha, *Res. Quart.*, 14, 23, 1943.
- 4a. Brouha, L., and J. R. Gallagher, *Rev. Can. Biol.*, 2, 395, 1943; and *J. Health and Phys. Ed.*, 14, 517, 1943.
5. Johnson, T. J., *J. Health and Phys. Ed.*, 15, 9, 1944.
6. Gallagher, J. R., L. Brouha and T. J. Johnson, *Yale J. Biol. and Med.*, 15, 781, 1943.
7. Cureton, T. K., *J. Am. Med. Assn.*, 123, 69, 1943.
8. Cozens, F. W., M. H. Trieb and N. P. Neilson, *Physical Education Achievement Scales*, (New York: A. S. Barnes & Co., 1936).
9. Kiphuth, R. J. H., Personal communication.

A Study of The Results of Eight Weeks of Participation in a University Physical Fitness Program for Men

By J. W. KISTLER
Louisiana State University
Baton Rouge, Louisiana

INTRODUCTION

TODAY, probably as never before, we are concerned to know how successful we are in achieving our goals in physical education. This is particularly true with respect to the physical fitness goal.

This study had for its purpose that of investigating the amount of improvement which was achieved through regular participation over a limited length of time in a program designed primarily to improve strength, endurance, and agility, three of the elements of fitness which the authorities say are needed by our armed forces.

SUBJECTS USED

The 1,650 men whose achievement scores were used in this study were students of Louisiana State University who were enrolled in the regular required physical fitness classes, and who were judged by the Student Health Department of the University to be physically able to participate in a program of vigorous conditioning activities.

Practically all of these men had had at least one semester of participation in the program prior to the semester during which this study was made. All of them had taken part in the program for the nine weeks immediately preceding the one during which the investigation was concluded.

NATURE OF THE TRAINING PROGRAM

The training program in which the men participated was eight weeks in length. During this time the men met in class three times each week for a thirty-minute workout, usually outdoors.

The class period consisted of approximately eight minutes of calisthenics and four bouts of exercise, each five minutes in duration. During the calisthenics stress was placed on stretching and bending exercises, sit-ups, push-ups, and deep-knee bends. The five-minute bouts of exercise were devoted to all-out chinning, obstacle-course running, personal-combat activities, and running.

During the five minutes at the chinning bars, the men were given two opportunities to extend themselves in chinning. Occa-

sionally a simple stunt was taught and practiced. For the most part, however, the work consisted of actual practice in the usual method of chinning the high bar.

The obstacle-course running was done over a course which was seventy-five yards long, in which there were eight obstacles evenly spaced. The obstacles consisted of a handvault rail, a ditch eight feet wide and two feet deep, a crawling barrier, three hurdles, an eight-foot wall, and a twenty-five foot balance beam.

After the men were taught how best to do each obstacle the period was devoted to running the course against time. Occasionally the men were asked to run it both ways, or were required to run the seventy-five yards back to the starting line on an open track laid off on the side of the course.

Pick-a-back wrestling, modified boxing, catch-as-catch-can and Indian wrestling were included in the personal combat period of exercise.

The running program was varied from day to day and consisted of cross-country running, wind sprints, and relays of from fifty to four hundred and forty yards.

The class averaged thirty-five students to the instructor.

TESTING PROCEDURE

A battery of five tests which are described below was administered to the men twice in making the study. The initial testing was done during the last week of the first nine-week period of the semester. This testing was done to determine the mid-term grade which the men received. The final testing was carried out during the last week of the semester and again served to provide a basis for the course grade. In both instances there was no problem of motivation as the men were anxious to make the best possible score since they knew that their grade in the course depended upon their achieved scores.

The five tests which were used in the study consisted of the following: (1) a five-minute run for distance, (2) an obstacle course run for time, (3) push-up test, (4) chinning test, and (5) sit-up test.

In the *five-minute run for distance*, the men ran over a course which was one mile in length. The course was marked off into zones of one hundred yards each with the first zone beginning at a point five hundred and sixty yards from the starting line.

The men ran for five minutes at the end of which time a whistle was blown and they were then scored according to the zone which they had reached. Credit was given for the zone reached even though the runner had barely crossed the line which marked the beginning of the zone in question.

In the *obstacle-course run* four men were run at one time and the score was the time consumed in completing the course.

In executing the *push-up test*, the men started from the front-leaning rest position, lowered the body by bending the elbows until the chest touched the ground momentarily, then returned to the starting position as many times as they could. No deviation from the straight line position of the body was permitted in the execution of the test.

Standard procedures were followed in administering the *chinning test*. The men started from a straight-arm hanging position on the bar and pulled up to a position with the chin slightly above the bar. They then lowered to the starting position and repeated as many times as possible. Slight swaying was permitted but no appreciable bending at the hips was allowed. The palms-front grip was used.

The *sit-up test* was executed by bending back from the sitting position with back arched and touching only the hands, which were clasped behind the head, to the ground, returning to the sitting position and then bending forward to touch one elbow to the opposite knee alternately, then backwards again, and so on as many times as possible. Feet were held at the ankles by a classmate throughout the exercise.

The five-minute run was administered on one day, the obstacle-course run and the push-up test, on another, and the chinning and sit-up test, on a third day.

All counting and scoring was done under the strict supervision of the class instructors.

RESULTS

Table I shows the per cent of students who improved, declined, or showed no change in ability as a result of the eight weeks of participation.

TABLE I

PER CENT OF STUDENTS WHO IMPROVED, DECLINED, OR SHOWED NO CHANGE IN ABILITY AFTER EIGHT WEEKS OF PARTICIPATION

Ability	Improved	Declined	No Change
Chinning -----	61%	15%	24%
Sit-up -----	77%	16%	7%
Obstacle-Course Run -----	61%	21%	18%
5-Minute Run -----	36%	17%	47%
Push-up -----	74%	18%	8%

The greatest number of students improved in ability to do the sit-up test. Seventy-seven per cent of the men showed increased ability in this respect. It is interesting to note, however, that an appreciable number did not do as well in the final test as they did in the initial test. This may be explained by the fact that some of

the men were satisfied with the grade they made at the mid-term and so did not try to exceed their scores made on the initial test. Anyone who has tried to go "all out" on the sit-up test knows that it takes some determination to keep going as the physiological limit is approached.

In the ability to do push-ups seventy-four per cent of the men improved as a result of the eight weeks of training, eighteen per cent lost in ability, and eight per cent showed no change as a result of the training.

The chinning and obstacle course records reveal that sixty-one per cent of the men improved in their ability to do these activities. A higher percentage of men declined in ability to run the obstacle course than was true in any of the other tests. This finding may be explained by the nature of the test itself. A loss of balance at any one of the barriers in the course, or a failure to time the hurdling properly will easily account for a few seconds difference in the runner's score. The test is not highly reliable in the writer's opinion.

Fewer men demonstrated improvement in the ability to run for five minutes than in any of the tests administered. Only thirty-six per cent improved their initial scores in this event while seventeen per cent and forty-seven per cent declined and demonstrated no improvement respectively.

Study of Table I reveals that a surprising percentage of the men retrogressed in their ability during the training period. Analysis of the data, however, reveals the fact that the majority of these men were in the upper bracket of performers. Experience has demonstrated that it is more difficult for the top bracket performer to consistently perform up to his best than it is for the one of average or below average ability. Generally those in the latter classification have not come as near to their best possible achievement as have those who rank at the top in demonstrated ability.

TABLE II

PER CENT OF STUDENTS WHO IMPROVED IN FIVE, FOUR, OR THREE ABILITIES
AFTER EIGHT WEEKS OF TRAINING

<i>Improved In Five Measures</i>	<i>Improved In Four Measures</i>	<i>Improved In Three Measures</i>
9.8%	27%	33%

Approximately ten per cent of the men who took the training improved in their ability to perform in all five of the measures recorded. Twenty-seven per cent increased their scores in at least four of the five tests while thirty-three per cent gained in ability in three of the measures. Sixty-nine per cent of the students improved in three or more of the measures used in this study.

TABLE III

AVERAGE PERFORMANCE AND PER CENT OF GAIN ACHIEVED IN PHYSICAL FITNESS TESTS AFTER EIGHT WEEKS OF TRAINING

Test	Average Performance		Gain In Performance	Per Cent Gain In Performance
	Initial Test	Final Test		
Chinning -----	10.0	10.8	.8	8%
Sit-ups -----	38.4	51.1	12.7	34%
Obstacle Course Run -----	24.7 sec.	22.0 sec.	2.7 sec.	10.9%
Five-Minute-Run for Distance	1490 yds.	1510 yds.	20 yds.	1.3%
Push-ups -----	18.1	21.3	3.2	17.6%

Study of Table III reveals the fact that the greatest amount of improvement in the physical fitness elements was made in the ability to do body sit-ups. The average improvement was thirty-four per cent.

The least amount of improvement was registered in the five-minute run for distance. The fact that the zones of the course over which the run was made were one hundred yards in length may have lessened the chances of a better record in this event. Had the unit of measurement been smaller, it is possible that the findings would have been different. For many of the men one hundred yards offered too great a challenge to overcome.

The ability to do push-ups was improved to an appreciable degree by the men in the training program. The average improvement in this item was 17.6 per cent. Ability to run the obstacle course, a test primarily of agility in the writer's opinion, was next in order of improvement. A 10.9 per cent gain in this element of physical fitness was recorded. In the ability to chin the men demonstrated an average improvement of 8 per cent.

It is possible that the reason why body sit-ups and push-ups ranked first and second in the order of improvement is to be found in the fact that many of the men practiced these events in their rooms before retiring at night and at other odd moments. Knowing that they were to be tested on these two abilities they worked for the improvement whenever convenient.

The average performance achieved by the men in this study compares favorably with that achieved by men in the Army Specialized Training Program which is now being conducted in many of the universities and colleges of the country.

In the chinning test the performance of the men in this study exceeded the average reported for the A.S.T.P. groups by better than two chins. Some of this difference may be explained by the fact that in this investigation the men were allowed to use the reverse grip while the soldiers are required to use the front grip.

The score made by the men who took part in this study in

doing body sit-ups is quite superior to the average compiled by the A.S.T.P. students and is particularly significant considering the fact that the manner in which the university students executed the test is much more difficult than that followed by the Army students. The arched back position required in the execution in this study places a more constant strain on the abdominal muscles than does the curl position used in the A.S.T.P. testing program.

The conditions under which this study was carried on made it necessary that a test be used in which the subject would reach his limit of performance in a relatively short period of time.

The average performance in ability to do push-ups recorded in this study is approximately 18 per cent higher than that reported for the A.S.T.P. students.

Comparison is not possible in the matter of obstacle-course running and cross-country running scores since these events vary as administered in different stations.

CONCLUSIONS

1. The findings of this study would seem to justify the statement that significant improvement may be achieved in the physical fitness elements of strength, endurance, and agility through a specific training program devoted to these elements.

2. The time required for achieving physical fitness of the type involved in this study is not excessive.

3. Of the physical fitness elements investigated in this study, endurance of the cardio-respiratory type appears to be the most difficult to improve. Strength and endurance of the type measured in doing sit-ups and chinning are most amenable to improvement through systematic training procedures.

4. An appreciable per cent of men actually demonstrate retrogression in ability to perform in motor activities of the type used in this study, during a training period of eight weeks.

5. University men compare favorably with men of the Army Specialized Training Units in their ability to chin themselves, do push-ups, and sit-ups.

A Study of the Distance Traveled By Basketball Players

By LLOYD L. MESSERSMITH
DePauw University
Greencastle, Indiana

THIS study was concerned with the development of a measuring device which could be used to measure the distance traversed by individuals while playing the game of basketball on courts of different dimensions. There had been much speculation regarding the probable distances traveled by players in basketball, and similar sports, but previous to this study no satisfactory method of measurement had been devised which could be applied to the problem. Distances traversed by participants in track were known because of the measured course over which all competitors ran. Estimates had been made of the distances traversed by participants in golf, hiking, etc., through application of the pedometer, but this measuring technique was not applicable to games such as basketball because of the nature of the measuring device which was calibrated to a stride of measured length. Obviously this means of measurement could not be applied in a game where players were constantly changing the length of their steps.

The present study was first started in 1931 when the author, in collaboration with S. M. Corey, began work on a measuring device which could be used in determining distances traversed by basketball players.* Since that time the writer has continued the development and application of the measuring technique until a reliable and readily applicable device is now available. Data are now available on a representative number of basketball players participating on courts of varying sizes.

PURPOSE OF THE STUDY

The purpose of this study was two-fold; first to develop a measuring technique which could be used in determining the distances traversed by basketball players playing on courts of three different sizes, and secondly, to ascertain, if possible, the relationship which floor size had upon the distance traversed per unit of playing time. On the basis of these data certain conclusions have been reached regarding court sizes, effect of rule changes upon distances traversed by players, and the effect of position played upon distance traversed.

This is an abstract submitted in partial fulfillment of the doctoral degree at Indiana University.

* Lloyd Messersmith and S. M. Corey, "The Distance Traversed By a Basketball Player," *Research Quarterly*, 2:2 (May, 1931) pp. 57-60.

DELIMITATION OF FIELD

This study was limited to the development and application of a measuring technique as applied to individuals playing the game of basketball. Distance data were secured on players who participated in games while playing on courts of the following sizes: 94' x 50', 74' x 50', and 70' x 40'. The 94' x 50' court was used by players representing college teams in Indiana and the Big Ten Intercollegiate Conference. The 74' x 50' court was used by both "A" and "B" team players in secondary schools of Indiana, while the 70' x 40' court was used by college students while participating in intramural basketball games. For comparative purposes records were also made of the intramural teams competing on the 74' x 50' size floor used by the secondary school teams. While the 74' x 50' court is considered regulation size for the secondary schools, the 70' x 40' court is comparable to that in use by many of the smaller secondary schools of the country which are not equipped with modern gymnasiums.

THE MEASURING INSTRUMENT

The measurement was made possible through the development of an electrical pursuit apparatus which provided for numerical registration of unit distances traveled.† The device consisted of a metal floor, laid off to scale (four feet to the inch), wired in series with dry batteries, an electric impulse counter, and a small brass tracing wheel four inches in circumference, insulated at half-inch intervals on the circumference with adhesive tape. As the wheel was rolled over the surface of the metal floor, a series of makes and breaks in the electric circuit were produced, each one of which, with the calibration employed, represented a distance of two feet on the playing floor.‡ These makes and breaks were recorded on a cumulative impulse counter and it was only necessary to multiply the number of impulses by two in order to ascertain the number of feet traversed by a player under observation.

In determining the distance traveled by a player, the experimenter followed the movements of the player under observation with the small tracing wheel, duplicating on the metal floor the route followed by the player on the playing floor. Free-throw lines, center circle, boundary lines, etc., marked on the metal floor, aided the experimenter in keeping the player under observation accurately located at all times. Observations were made from a position above the floor from which the experimenter had a clear and unobstructed view of the entire playing surface at all times.

Using the scale, (four feet to the inch), nine experimental floors were constructed; three representing the 94' x 50' floor used by college teams, each $23\frac{1}{2}'' \times 12\frac{1}{2}''$; three representing the 74' x 50' floor used in secondary schools, each $18\frac{1}{2}'' \times 12\frac{1}{2}''$, and three representing the 70' x 40' floor used by intramural teams, small secondary schools, class teams, etc., each $17\frac{1}{2}'' \times 10$ inches in size.

wheels were cut by a machinist and mounted on a handle to facilitate the guiding of the wheel by the experimenter. Rubber bands were used to secure the impulse counter when the equipment was in transit.

This arrangement provided a compact piece of equipment which could be easily transported from one location to another, assembled, and taken down quickly, and requiring a minimum amount of space when in operation. In some instances it was possible for the experimenter to place the apparatus on a table when in operation as, for example, when accommodations were available in the press box. In other cases it was necessary for the experimenter to place the box containing the batteries between his feet on the floor, and hold the board containing metal floor and impulse counter on his knees. Either arrangement worked quite satisfactorily. The assistant sat beside the experimenter and recorded data from impulse counter during the progress of the game under observation.

THE VALIDITY OF THE MEASURING INSTRUMENT

Using the instrument to measure specific distances produced results very similar to the known distances. Rolling the wheel from one side line to the other on the metal base representing the high school or college floor, produced a total of twenty-five impulses, which multiplied by two gave fifty, the width of the floor in feet. Similarly, directing the wheel from one end of the $23\frac{1}{2} \times 12\frac{1}{2}$ " floor to the other, produced forty-seven impulses, which multiplied by two gave ninety-four, the length of the college floor in feet. In measuring a much longer distance, namely 33,840 feet, or 6.40 miles, which represented three hundred excursions up and down the ninety-four foot floor, the instrument recorded 33,202 feet, or 6.29 miles, an underestimation of 1.75 per cent of the actual distance. Several comparable tests produced similar results indicating that any inaccuracy in the results obtained were due to the inability of the operator to follow accurately the movements of the player under observation. Errors of over and underestimation probably canceled so that the final result was, in all probability, a reasonably accurate record of the actual distance traversed.

RELIABILITY OF DATA

Each experimenter was subjected to a training period in order to secure reasonable uniformity in technique of handling the tracing wheel. Different experimenters clocking the same player during the same game secured results which indicated a difference in total distances of approximately 3.50 per cent. In game one, operator "A" clocked a forward at 3.20 miles and operator "B" measured the distance at 3.25 miles, a difference of 1.72 per cent; in game two the total distances were 3.10 and 3.22 miles respectively, a difference of 1.76 per cent; and in game four the distance totaled 3.26 miles and 3.32 miles respectively, a difference of 1.92 per cent.

PROCEDURE IN COLLECTING DATA

In making plans to collect data on players in a contest, the experimenters arrived on the scene well before game time and stationed themselves above the floor where an unobstructed view of the playing area was available at all times. When clocking basketball players, three boards were occasionally used; one experimenter followed a forward, one the center, and one a guard. If a starting player were replaced by a substitute the second player was clocked while in the game, unless a shift in position were made, in which event, the person playing the position formerly held by the player leaving the game was clocked. In all games an effort was made to keep data on positions and only on individuals when they played one position during the course of the entire game. In a large number of cases the player under observation did play the entire game.

PLAYERS INCLUDED IN STUDY

Data were collected on two hundred players during the course of the study. Of this number, 57 represented college players, 63 secondary school "A" players, 32 secondary school "B" players and 48 players on college intramural teams. Data for college players were taken on the basketball floors at DePauw and Indiana Universities while data on secondary school players were obtained on the Greencastle High School basketball floor and intramural data on the intramural courts at DePauw University.

A study of Table I shows the mean distance traveled by the players in the various groups to be as follows: college, 3.34 miles per game; secondary school "A," 2.45 miles; the secondary school "B" players, 1.83 miles; and the college intramural players, 2.10 miles per game. To make a more accurate comparison among the players on different teams it is necessary to have information regarding distance traversed per unit of playing time. The college games were 40 minutes in length while the secondary school "A" and intramural games were 32 minutes in length. The secondary school "B" games were usually limited to 24 minutes. The mean distance traversed by all players in the various classes per minute was as follows: college, 441 feet; secondary school "A," 404; secondary school "B," 405; and intramural games, 345 feet.

As seen from Table I, the position played made little difference in distances traversed. In colleges and secondary school "A" games the centers traveled somewhat greater distances than players in other positions but the difference was not statistically significant.

Data were also collected showing distances traversed by players on offense and defense, but in most games there was no appreciable difference between the distances traveled by players when in possession of the ball and when on defense. After inclusion of the rule eliminating the center jump the number of ball changes per game

TABLE I
DISTANCE TRAVELED AND BALL CHANGES PER GAME IN ALL GAMES
INCLUDED IN STUDY

<i>Players and Position Played</i>		<i>Means</i>		σ		σm	
	No. of						
<i>College</i>	Players	Miles	Ft. Per Min.	Ball Changes	Miles	Ball Changes	Miles
Forwards	19	3.26	430	131	.23	13.77	.053
Guards	17	3.33	439	132	.29	12.58	.070
Centers	21	3.44	454	131	.44	14.74	.095
Totals	57	3.34	441	132	.339	13.84	.045
<i>Secondary School "A"</i>							
Forwards	20	2.48	409	122	.30	12.88	.068
Guards	22	2.38	391	120	.31	12.41	.067
Centers	21	2.51	413	120	.32	12.28	.069
Totals	63	2.45	404	121	.304	12.53	.039
<i>Secondary School "B"</i>							
Forwards	11	1.88	416	88	.19	8.81	.057
Guards	10	1.75	385	88	.14	7.94	.045
Centers	11	1.87	413	88	.16	7.82	.048
Totals	32	1.83	405	89	.170	8.35	.030
<i>Intramural</i>							
Forwards	16	2.20	363	105	.23	11.46	.059
Guards	14	2.07	340	108	.12	11.26	.032
Centers	18	2.02	333	105	.16	11.22	.041
Totals	48	2.10	345	106	.215	11.38	.031

was increased over fifty per cent. According to the present rules the ball must change hands after every goal from the field but before the elimination of the center jump, after scoring a goal, it was possible for a team to retain possession of the ball for a considerable period of time even though several goals were scored from the field during this period.

THE EFFECT OF FLOOR SIZE UPON DISTANCE TRAVERSED

The results of this study point out rather definitely that the size of the playing floor has a direct bearing upon the distance traversed by individuals engaged in playing the game of basketball. Other factors, such as age of the player, physical condition, style of game employed by team, quality of competition, etc., undoubtedly have some bearing upon the situation but not one of these factors carried the weight of floor size in its effect upon the distance traversed.

College players playing on a court 94' x 50' in size, traveled 441 feet per minute, or approximately 40 feet more per minute than individuals playing on courts 74' x 50' in size. That the size of the court and not other factors, was the determining factor in this dif-

ference is attested to by the fact that the same team traveled considerably farther when playing on the large floor. Teams which averaged 345 feet per minute, when playing on a floor 70' x 40' in size, increased this distance to 400 feet per minute when playing on the 74' x 50' court. While full games are not available, several practice sessions were clocked of intramural teams, who normally played on the 70' x 40' court, in practice sessions with teams on the 74' x 50' floor. In these practice sessions the distances traversed approximated 400 feet per minute and it seems reasonable to assume that a comparable speed would be maintained for a full game under the stimulus of actual competition. These data lead us to the conclusion that floor size is the predominate factor in determining the distance traversed by basketball players, other factors such as physical condition, quality of competition, and style of play, being equal.

The individual playing on the 94' x 50' court had an area of 4,700 square feet over which to run, while the player on the 74' x 50' court had 3,700 square feet as compared with only 2,800 square feet for the player on the 70' x 40' floor. This situation gave three different size courts each varying approximately 1,000 square feet from the next nearest size floor. The relationship existing between floor size and distance traversed per unit of playing time is illustrated by these figures in which distances traversed on the three courts were 441, 404, and 345 feet per minute, starting with the largest floor. A decrease in floor area of 1,000 square feet produced a decrease in distances traversed of 42 feet per minute between intercollegiate and secondary school players, while a decrease of 900 square feet produced a decrease in distance traversed of 59 feet per minute between the secondary school and intramural player. The greater percentage of decrease in activity found between the 74' x 50' and the 70' x 40' floors is probably due to the fact that the law of diminishing returns sets in as the floor size is decreased beyond a certain point. It is probable that the small 70' x 40' floor restricted the player's activity in greater proportion than did the 74' x 50' floor over the 94' x 50' floor. If floor size were further reduced it is probable that the rate of activity on the part of players would decrease by still greater proportions.

THE EFFECT OF CERTAIN RULE CHANGES UPON DISTANCE TRAVERSED

An opportunity was afforded in this study to check the effect of two rule changes upon the distance traversed by college players, namely the ten-second rule and the rule eliminating the center jump after the scoring of a goal. The ten-second rule required the team in possession of the ball to advance it past mid-court, or offensive line, within ten seconds after gaining possession of it, while the rule eliminating the center jump after scoring of a goal kept the ball in play a greater percentage of the time because no portion of the

actual playing time of the game was consumed in taking the ball back to the center for the toss-up.

Data were collected on college teams for the first time in 1931, employing the same instrument used for collecting later data used in the study. At that time the distances ranged from 2.12 to 2.65 miles per game, with a mean distance of 2.25 miles for the games clocked. It is unfortunate that no data are available on games immediately following the inclusion of the ten-second rule and before the passage of the rule eliminating the center jump. The tremendous effect upon the game's activity of these rules is evidenced by the fact that distances jumped from an average of 2.25 miles per game to 3.30 miles, an increase of over one mile per game, or about fifty per cent. The great increase in distances traversed was undoubtedly due to the combined effect of these two rules, but the writer is of the opinion that the rule eliminating the center jump made the greater contribution. The ten-second rule was passed to prohibit deliberate stalling and withholding the ball from play and did not increase materially the activity of teams which had always sought to advance the ball within scoring range at their earliest opportunity. Most good teams found it unnecessary to change their style of play because of the inclusion of this rule.

The rule eliminating the center jump, however, made a marked change in the activity of players engaged in the game. Instead of the field goal being the signal for a breathing spell, it became the focal point for increased activity whereby the team scored or attempted to catch the defense off its guard by an unexpected burst of speed, a procedure impossible under old rules. This possibility made it imperative that members of the scoring team always change direction immediately following the scoring of a field goal and set themselves for an offensive attack by the opposing players. All this required increased running on the part of both teams and undoubtedly made a significant contribution toward the great increase in distances which was found after inclusion of these rules. The application of this rule also increased the playing time available because it eliminated the time-consuming procedure of taking the ball to the center of the floor for the toss-up immediately following the scoring of a goal.

Much of these data were collected while observing the DePauw University basketball team, a team coached by the same individual before and after the inclusion of the new rules. The general style of play employed by the teams during this period was not greatly varied and changes, when made, were usually those necessitated by, or made possible, through the application of the rules under consideration. The measuring device used in both instances was the same in principle so it seems reasonable to assume that the great increase in distances traversed was due to the two rules.

SUMMARY

1. A measuring instrument was developed consisting of an electrical pursuit apparatus which provided for numerical registration of unit distances traveled by basketball players.

2. Data were collected on 200 individuals playing basketball in game situations on basketball courts of three different sizes: 94' x 50' (college players), 74' x 50' (secondary school "A" and "B" players), 70' x 40' (college intramural players).

3. The mean distance traversed by players included in the study, per game, was 3.34 miles for college players; 2.45 miles for secondary school "A" players; 1.83 miles for secondary school "B" players; and 2.10 miles for college intramural players.

4. The mean distance traversed by players included in the study, per minute of playing time, was 441 feet for college players; 404 feet for secondary school "A" players; 405 feet for secondary school "B" players; and 345 feet for college intramural players.

5. Differences in distances traversed between players in the various positions, i. e., forward, guard, and center, were not significant.

6. The inclusion of the ten-second rule and the rule eliminating the center jump increased the activity of players, as measured by distances traversed, by fifty per cent.

Individual Differences in Motor Adaptations To Rhythmic Stimuli

By EDITH C. HAIGHT
*Eastern Illinois State Teachers College
Charleston, Illinois*

THE NEED FOR THE STUDY

ALTHOUGH the fact has long been accepted that rhythm is a fundamental and characterizing factor in activities and that individuals differ in their capacities for making adaptations to these rhythms, comparatively little has been done experimentally in studying the range of the individual's capacity for making such adaptations or the variations of individuals in making adaptations to a specific rhythm pattern. The lack of an objective method by which to judge students of dancing has long been a handicap to instructors in this field. This handicap has been felt all the more keenly since Heinlein¹ demonstrated the inaccuracy of judgment of trained musicians in determining so simple a matter as whether or not a subject is walking in time to the march being played. To discover how individuals differ in their responses to specific rhythm patterns and to throw light upon the process of learning such a pattern would be not only a first step in the direction of an objective base for determining rhythmic ability but also would be valuable and significant knowledge for all teachers of activities in which rhythm of performance is an important factor.

THE PROBLEM STATED

The problem with which the research is concerned is to discover what the individual differences are in the capacity for making adaptations from the walking rhythm to rhythmic stimuli. The underlying basic assumption that good athletes have in a high degree this quality called rhythm raises several questions upon which an understanding of individual differences would throw light. It is possible to predict athletic and dancing ability on the basis of rhythmic response to specific stimuli? Do characterizing features of the responses indicate aptitudes for specific sports? Do sex differences exist?

DELIMITATIONS AND AMPLIFICATIONS

In such attempts as have been made to formulate tests for the sense of rhythm, there have been two outstanding weaknesses: (1)

(This is a condensation of dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the School of Education of New York University, 1943)

¹ C. P. Heinlein, "A New Method of Studying Rhythmic Responses of Children," *Pedagogical Seminary*, 36 (June, 1929), pp. 205-228.

the difficulty of differentiating between failure to sense the rhythm and failure to coordinate well enough to express the rhythm felt; and (2) as in the Seashore tests,¹ the difficulty of differentiating between failure to sense the rhythm and failure to retain in memory the rhythm pattern during the interval until judgment may be given. In the present study, the first difficulty has been avoided by keeping the responses asked for strictly within the limits of walking coordinations. The second difficulty has been eliminated by making the rhythmic stimuli continuous throughout the interval that response is requested.

Since the concern of the investigation is with adaptation to rhythmic stimuli, it was desirable to use a form of motor response which would not present any inherent difficulties of coordination. Walking was chosen since it is a total body coordination which for adults has become so well established that it has receded into the area of automatic response. Quite a wide range of adaptability is represented between the leisurely stroll of a Sunday afternoon walk and the rapid pace necessary when one fears to be late. Unevenness of surface and unexpected obstacles also demand constant adaptations of the walker. Since there is habitual adaptation of the walking rhythm, it seems highly probable that basic differences in capacity for rhythmic adaptation could be detected through a study focused in this area.

PROCEDURE

How to accurately record the walking steps of an individual and what method to use for providing the rhythmic stimulation were mechanical problems which had to be solved at the outset. The instrument finally constructed was compact enough to be transportable and included in the one unit both the means for recording the moment of contact of the subject's foot with the floor and the means for initiating the rhythmic stimuli to be used.

Leather foot pieces were devised which could be laced on over the ordinary street shoe. Two thin pieces of copper were attached to the bottom of each foot piece in such a way that contact of the subject's foot with the floor brought the two pieces of copper in contact, thus completing an electric circuit operating recording pens.

The signals used as stimuli were a buzzer, a light, and a combination of simultaneous buzzer and light signals. The principle of the player piano was used in producing these signals. Paper strips with cut-out intervals for the desired pattern were placed around an electrically wired wheel moving at a known rate of speed. The signals occurred in coincidence with the cut-out intervals.

The buzzer was mounted on the instrument base and was clearly audible throughout a large gymnasium. The light signals were pro-

¹ C. E. Seashore, *Measures of Musical Talent*, (Camden, N. J.: R. C. A. Manufacturing Co.)

duced by a small flash light bulb mounted at the end of a projection attached to the front of a light weight sun helmet which the subject wore on his head. The flash of the light was clearly visible to the subject and yet he was free to hold or move his head in any customary manner while walking, and hands and arms were free to swing naturally.

For the final experiment, five different rhythm patterns were used, each presented to the subject by the three types of stimulation, auditory, visual, and a simultaneous combination of the two.

Preliminary experimentation was conducted to determine whether the natural walking reactions of subjects would be affected by the unusual elements of the foot pieces and the wire connections. The results of these preliminary tests indicated that wearing the foot pieces and the wire attachments would not cause significant variation from the normal walking gaits of a subject.

Subjects for the experiment were selected in sets of fifteen on the basis of their athletic and dancing ability by the staff members of the physical education departments of the cooperating colleges. Three classes of subjects were included in each set; one group consisting of five highly skilled athletes and dancers; one group of five individuals who by choice consistently avoided all such activities or who did poorly in them when forced to participate; and a middle group of five average athletes and dancers, neither very good nor very poor.

Techniques for giving the tests were developed and records were made of the responses of selected subjects in eight different colleges.

The records were analyzed by the use of a specially constructed mechanical device to determine the relation of the subject's step to the pattern signal in terms of $1/20$ second units. These data were then recorded on special tabulation sheets, or distribution charts, a separate chart for the record of each one of the fifteen pattern-stimulus combinations to which an individual was asked to adjust his walking step.

Six hundred seventy-five records made by forty-five subjects were analyzed and form the basis for the results.

RESULTS

Two different approaches were used in the analysis of the results. One approach was a study of the responses of the subjects to the rhythm pattern as a whole. The other approach was a study of the responses of subjects to the component signals of the selected rhythm patterns. By using as a criterion of success, the individual's average percentage of accuracy (the quotient of the number of his steps which synchronized with a signal of the given rhythm pattern divided by the total number of steps required for the specified number of repetitions of the pattern) various comparisons were possible. The findings may be summarized as follows:

1. The ability of subjects to synchronize the walking step with given rhythm patterns varies greatly both among individuals and also with the same individual's different attempts with different patterns and with the same pattern under the circumstances of different stimuli.

2. Individuals who succeed in synchronizing the step with a given rhythm pattern do not then maintain this synchronization.

3. Subjects tend to take extra steps or to omit steps when confused by the rhythm.

4. When the pattern is sensed there is a tendency toward systematic approach and retreat from perfect synchronization of steps with the signals of the given pattern.

5. When the pattern is not sensed the responses seem to be widely scattered and miscellaneous in their time relationships.

6. Subjects who sense the pattern seem to establish definite patterns of performance with fairly consistent time relationships between the steps. These time relationships seem to be the individual's improvisation upon the theme of the rhythm pattern given by the stimuli.

7. Subjects as a group succeed in synchronizing with the rhythm patterns more often on the fourth, fourteenth, and twentieth repetitions of the twenty-five trials allowed.

8. The ranking of subjects on the basis of percentage of accuracy and their ranking on the basis of athletic ability or background of activity experience seem to have little or no relationship.

9. The ranking of subjects on the basis of percentage of accuracy shows a slight but insignificant relationship to their backgrounds of musical experience.

10. There is definite correlation between the subject's percentage of accuracy score and the total number of times in which he is able to synchronize his steps with all signals of specific repetitions of the rhythm patterns.

11. Subjects are more accurate in responding to the buzzer stimulus than in responding to the light stimulus or to a combination of buzzer and light.

12. There is slight indication that the two rhythm patterns most nearly like the normal walking gait are the least difficult of the five patterns used but the evidence is inconclusive.

13. Subjects tend to be more accurate with certain ones of the component signals of a rhythm pattern than with the other signals or than with the pattern as a whole.

14. There is some evidence that those fewer subjects who are more accurate with the middle signals of a rhythm pattern are apt to make higher total accuracy scores than subjects whose greater accuracy occurs on the first and last signals of the pattern.

CONCLUSIONS

The results of the experiment lead to the following conclusions:

1. The range of individual differences is so great as to suggest a uniqueness in individual approach to the problem of adapting the walking step to an objective rhythm pattern. However, a much larger number of cases would need to be tested before the evidence would be conclusive.

2. Having sensed a rhythm pattern and succeeded in synchronizing with all component signals of the pattern, a subject does not then maintain this complete synchronization but rather seems to establish his own pattern of performance as an improvised variation on the given pattern theme. The pattern which he establishes tends to show a systematic approach and retreat from complete synchronization with the given pattern.

3. Rhythmic response is more accurate when initiated by auditory stimulation than when initiated by visual stimulation or by a combination of auditory and visual stimulation.

4. The responses of subjects seem to indicate that the range of difficulty for the five patterns used is not very great and that individuals vary greatly in their preference for the different patterns. In other words it would seem that the problem of adjusting the walking step far outweighs in importance to the subject the problem of the character of the particular pattern to which he is adjusting.

5. Although the evidence is insufficient to be conclusive, nevertheless there are definite indications to suggest the possibility that there are two types of individuals: those who sense a rhythm pattern in terms of a unit-time relationship, and those who sense the pattern in terms of the time relationships between its component signals. The latter group seems to be the minority group and the group which achieves the higher percentages of accuracy for total performance.

6. There is no evidence for the forty-five men and women studied that success in adapting the walking rhythm to the rhythm patterns used bears any relationship either to skill in athletics and dancing, or to past musical experience. This would tend to indicate that success in adapting to objective rhythms is an innate quality rather than an acquired skill.

7. Although some differences are apparent in the responses of the men and women subjects, the present findings do not indicate any characteristics peculiar to the groups, but seem rather to suggest that these differences are but aspects of the wide range of individual differences.

DISCUSSION

The extreme variability of the subject's response in adapting the walking rhythm to given patterns suggests that the area of adaptations from the walking rhythm is a fertile one for the study of

individual differences in response to rhythmic stimuli. It also suggests that possibly synchronization with a rhythm pattern is not a true gauge of the individual's ability to sense a rhythm, but rather that some means should be devised for evaluating the individual's variations on the theme of the pattern.

If further research should confirm the element of uniqueness in the individual's approach to his adaptation of motor coordination to rhythm patterns, and if basic elements of this uniqueness could be identified and studied, the efficiency of the educational process in assisting individuals to acquire motor skills could be greatly improved by the development of techniques appropriate to these basic elements. For example, there was an apparent tendency in this study for the more accurate individuals to use the preceding signal as a cue for the response to the succeeding signal of a rhythm pattern, whereas the larger group of individuals seems to select a favored signal and to regulate responses in terms of its recurrence with little regard for the intervening signals. This suggests the usefulness of some technique for assisting more individuals to acquire the former method. On the other hand, if further research should reveal this difference of approach to be an innate characteristic of individuals, consideration of the type of individual to be taught a skill and adaptation of the teaching techniques accordingly would certainly result in greater teaching efficiency.

It is clearly evident that the field of individual differences in walking adaptations to rhythmic stimuli offers a rich and challenging area for further research.

A Study of Factors Associated with Activity Choices of Participants in Organized Public Recreation Centers

By LEWIS K. SILVERMAN

*Formerly, Director, Douglas Park Recreation Center
Newark, New Jersey*

THE problem of increasing the popularity of the recreation program has been an important concern of recreation leaders for a considerable period. This is evident by the manifold writings regarding this objective and by the present existing conditions. In the City of Newark, N. J., approximately 7,000 different youth and adults attend public community centers. This is a small figure when one considers that the population of Newark exceeds 400,000 people. The failure of public recreation to compete with the commercial type of recreation, the spectator type of entertainment, is also a problem. This is manifested by a lack of balance within the program of public community centers. The shows and the special entertainment activities are always more strongly subscribed to even if a charge is made for admission. What are the influencing factors responsible for the lack of popularity of the recreation program and the unbalanced leisure pursuits of community center participants?

Possible influencing factors were selected on the basis of practical limitations and professional opinion.

The following factors were examined to determine whether they influence participation:

1. age
2. schooling
3. distance away registrants live
4. sex
5. intelligence
6. socio-economic status, as measured by:
 - a. land values of areas in which registrants live
 - b. crime data of areas in which registrants live
 - c. relief data of areas in which registrants live

The problem stated is the determination of the influence of selected factors on participation in organized public recreation centers of Newark, N. J.

This paper was submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the School of Education of New York University, 1942.

RELATED SUBJECTS

There were certain related research efforts which were useful in organizing this investigation. A comparison of the work of past investigators proved valuable for anticipating results and choosing suitable methodology. The experiments of the National Recreation Association of America,¹ Mary Baker,² Golden Romney,³ Lehman and Witty,⁴ and Cox and Cornell,⁵ lead to the conclusions that (1) the most popular activities performed during the free time of individuals were activities that were inexpensive, quiet, passive, and conducted in the home; (2) the activities not participated in, but which are desired should the opportunity be presented, are for outdoor activities away from home, involving not only active, but strenuous activities; (3) the factors of age, sex, marital status, environmental conditions, previous experience, intelligence, and socio-economic status have a modifying effect on participation in play activities; (4) extrinsic factors caused the lack of interest in the largest percentage of subjects; (5) nine out of ten girls preferred motion pictures for their leisure pursuits; (6) subjects showed unquestionable preferences for activities that were not physical education; yet the percentages not participating in physical education activities were small; (7) patterns of selections with similar elements, such as tennis and ping-pong, occurred in no greater frequency than those with anti-thetical elements.

What is true in one field is not always true in some other area of knowledge. For this reason, an experiment in the field of recreational education was decided upon as the way to determine the influence of the selected factors in recreation situations.

THE METHODS

Newark, N. J., by its nature was a good area in which to organize such a research since this type of study demanded that it be conducted in situations where it was possible to cater to a wide expression of recreational interests. In the Newark set-up recreational activities are open to all of the public without restrictions and any activity of a recreational nature is furnished in the community centers provided the registration is sufficient and the facilities available.

¹ National Recreation Association, *The Leisure Hours of 5,000 People* (New York, 1934).

² Mary Baker, "A Study of Factors Which May Influence Participation in Physical Education of Girls and Women, 15-25" (New York University, Doctor of Education thesis, 1939).

³ Golden Romney, "A Study of Factors that Contribute to Curricular Interests of Boys in the Junior High Schools with Special Reference to Physical Education" (New York University, Doctor of Philosophy thesis, 1936).

⁴ Harvey S. Lehman, and Paul A. Witty, *The Psychology of Play Activities* (New York: A. S. Barnes and Company, 1927).

⁵ Warren W. Cox, and Ethel L. Cornell, "Subjects Interesting and Uninteresting to Present High School Students," *New York State Education*, 18 (March, 1931).

On the basis of the freedom of selection one can more accurately determine the nature of activity choices. The nature of activity selection popularly deals with stated choices; however, a gap exists between what is stated as an activity choice and actual participation in the choices. It is for this reason that this study included as indicators of interest stated choices and choices manifested in participation. It was also a purpose of the study to determine if a consistency of selection prevails, whether individuals are partial to definite activities, or whether they select activities spontaneously.

By determining the stated choices and the actual participation in recreational activities and the factors contributing to such interests, recommendations can be made that will serve to assist administrators and teachers of recreation not only to attract more participants, but in setting up a satisfactory program of recreation for the youth and adult groups under consideration.

This investigation was based in part on 7,023 replies recorded on registration cards. These cards were filled out by the youth and adults attending community centers in the City of Newark, N. J. In addition to replies on the registration card designed to yield data of stated choices and certain factors, there were attendance records compiled during the community center season to depict the actual participation in the various activities. The information was procured from the ten community centers of Newark with which the registrants were affiliated. These community centers are spread throughout the city so that many different areas had representation. These varying geographic conditions gave weight to the conclusions.

Intelligence scores were obtained by administering 500 intelligence tests to community center registrants. The land values, crime, and relief data descriptive of socio-economic status were obtained through investigation of data relating to the areas in which the community centers were located. This was a necessary procedure since adult groups in community centers disliked any queries concerning their socio-economic status.

The influence of factors on participation was determined by employing freehand regression lines drawn to plotted points on correlation charts. The lines of best fit were used to predict the values of one variable that were associated with corresponding values of another variable.

THE RESULTS

THE NATURE OF RECREATION ACTIVITY SELECTIONS

The analysis of data concerning the nature of stated choices yielded the following results:

CHOICES STATED AT REGISTRATION TIME			ACTUAL PARTICIPATION IN RECREA- TIONAL ACTIVITIES		
Rank	Activity	Number	Rank	Activity	Number
1	Athletics	3,260	1	Special activities	114,233
2	Arts and crafts	976	2	Athletics	30,410
3	Clubs	727	3	Clubs	27,632
4	Dancing	683	4	Dancing	23,685
5	Music	491	5	Music	18,147
6	Dramatics	176	6	Arts and crafts	12,929
			7	Dramatics	4,275

When registrants were asked what they desired most, athletic activities received the highest registration. However, the actual participation differed from stated choices.

In actual participation, special activities were three times as popular as athletic activities. This reveals the tendency of people to observe rather than participate. This also reveals the indecision of activity selection. It was also found in the compilation of data that definite combinations of stated choices did not exist. Patterns of selections with similar elements such as cooking and knitting occurred in no greater frequency than those with dissimilar elements.

The lack of consistency of activity selections was further established by determining the relationship between stated choices and actual participation. The associations were graphically depicted by employing correlation charts. It was found that in most cases no association existed, and, where evidence of relationships did exist, a greater number stated an interest than actually participated.

The number of factors selected was narrowed down to eight:

The average ages ranged from 17.84 to 27.57 years. It is evident from this data that older people do not attend to any great extent and that the community center program appeals mostly to youth groups.

Registrants either came from a considerable distance to attend community centers or lived within a range of three to six blocks.

There were not enough differences in years of schooling among community center participants to account for the differences in participation. The average years of schooling ranged from 9.14 years to 11.25 years.

There were not enough differences in the percentage of males and females among the various community centers to account for the differences in participation. The sex percentages were about even with the balance slightly in favor of the boys.

Members of community centers came from varying socio-economic groups. This is revealed by varying land values and relief data of the areas in which the community centers are located.

The members of community centers differed in intelligence rather widely. The average intelligence scores ranged from 86.3 to

108.7. The members of community centers with the lowest average intelligence came from the slum areas, while the higher intelligence scores were obtained from the members of the community centers located in the finer residential areas of Newark, N. J.

<i>Recreation Centers</i>	<i>Yrs. of Age School- ing</i>	<i>Per Cent Living a Mile Away</i>	<i>Per Cent of Males</i>	<i>Intel- ligence</i>	<i>Land Values</i>	<i>Relief Per Cent</i>	<i>Crime Data Per Cent</i>	
Central	18.63	11.25	41.51	60.5	90.7	\$1.140	.0314	.0230
Ivy	No report	—	24.14	59.5	108.7	.351	.0128	.0006
Lafayette	19.43	10.15	4.49	54.0	90.5	.493	.0155	.0021
McKinley	19.17	9.58	6.20	62.5	91.5	.480	.0220	.0029
Morton	21.37	9.68	23.00	57.0	86.3	.985	.0212	.0027
Newton	18.16	10.19	5.15	54.8	94.4	.764	.0233	.0023
Prince	23.14	9.14	6.10	55.3	96.4	.600	.0212	.0027
Peshine	27.57	—	19.95	50.8	101.2	.399	.0104	.0013
Webster	17.84	10.59	3.56	59.5	93.5	.554	.0220	.0029
Wilson	20.92	10.02	7.63	74.0	92.0	.980	.0130	.0020

CONCLUSIONS OF THE STUDY

1. Age is a strong determinant of participation in all activity groups. Higher age increases participation in arts and crafts, music, dramatics, and special activities, and decreases participation in athletic, club, and dancing activities.

2. Distance away from the center that participants live is a determinant of participation in some activity groups. At community centers where a greater per cent of the members lived a mile or more away, there was a greater participation in arts and crafts and a smaller participation in athletics and special activities.

3. In those centers where a large per cent of participants came from a mile or more away there were outstanding activities offered by expert leadership.

4. Intelligence is a determinant of participation in certain activity groups. Greater intelligence increases participation in arts and crafts, dancing, and dramatics and decreases participation in club activities.

5. Land values of the areas in which community centers are located are determinants of participation in certain activities. Higher land values are associated with increased participation in athletics and club activities and decreased participation in arts and crafts activities. (On the basis of this study it was found that higher land values are descriptive of slum areas while lower land values were found to exist in the better residential areas.)

6. In the areas where people were poorest, the popularity of the community center program was greatest.

7. The factors of sex, years of schooling, and crime are not strong enough by themselves to account for the differences in participation.

8. Community center participants have a tendency to be spectators. This can be seen by the high participation in special events.

9. There is a lack of consistency between activity interests stated at registration time and actual participation in these activities. This suggests that an indecision and spontaneity of activity selection exists in public community centers.

An Activity Analysis of the Duties of Recreation and Informal Education Leaders and Supervisors

By JOE R. HOFFER
*Council of Social Agencies
Philadelphia, Pa.*

THE problem of this study is to determine what activities are performed by supervisors and leaders in the field of recreation and informal education. The interpretation to be placed on the statement of the problem is one which incorporates not only what they actually do, but what activities the leaders and supervisors say they perform or think they perform.

The investigator became interested in this problem because the nature of his position required an answer for purposes of developing in-service education programs, making job studies, providing informational service, and similar duties. Since an examination of the literature in this field disclosed no adequate statement or study, the present project was undertaken. Because there was a dearth of published material on the duties of leaders and supervisors in recreation and informal education, and since the sources of this information were available to the investigator, the study was limited to these two groups.

The term "recreation and informal education" has been adopted to define this basic social function. Other terms: group work, character building, leisure time, and social group work are also frequently used in literature and practice, in a similar relationship. Local and national agencies engaged in specialized services (non-school) related to play, recreation, and leisure, are included in this category.

The resulting product, that is, the Master List of Activities will be applicable, with certain modifications, to any community, but no attempt will be made to justify the program except in relation to the activities of recreation and informal education leaders and supervisors in Philadelphia.

Consideration of the literature in this field will reveal wide variations in the interpretations given the terms employed by writers and speakers. This is due in part to the development of specialized programs and methods, domination by strong national personalities who shaped or molded the programs; powerful national organizations

This paper is an abstract of the study.

with extensive resources in membership and facilities, resulting in large concentrations of interest, loyalty, and enthusiasm. These factors have contributed to the development of separate streams of thought reinforced by distinct philosophies expressed in a variety of ways. Some evidences of the uniquenesses claimed by the major national agencies are expressed by the "character-building" objectives of the Boy Scouts, the "citizenship" emphasis of the Boys' Clubs, the "recreation" features of participation by the National Recreation Association, the "neighborly or personal services" by the Settlements, and the "ethical" emphasis by the Young Men's Christian Association. The tendency toward "uniqueness" is further stimulated by the intense competitive struggle for finances which was the basis of growth in membership and influence.

Since this study concerns itself with an analysis of activities and practices, the investigator considered it quite important that a uniform usage of terms and the interpretations given them be understood; therefore, approximately twenty-five of the most commonly used terms are defined so as to implement precision in thinking with reference to this study.

BASIC ASSUMPTIONS

The attempt to analyze the duties of supervisor and leaders in recreation and informal education, like other projects involving logical thinking, necessarily starts from certain original assumptions. The major assumptions in this study are of three kinds: (1) those concerned with the present emphasis of the field of recreation and informal education; (2) those concerned with the presence of many generic activities among the specialized groups within the field; and (3) those concerned with the impact of closely allied social and educational movements.

PRESENT EMPHASIS OF THE FIELD OF RECREATION AND INFORMAL EDUCATION

The development of recreation and informal education can be summarized through the following sequence of emphases.

1. A sincere though unscientific, desire to "do better," with leadership characterized by idealism.
2. The development of specialized programs and methods for the attainment of clearly defined objectives, each agency placing emphasis on what the leaders seemed to think most vital.
3. Broadening of objectives—the interchange of professional leadership and achievement, and the acceptance of common sources of educated leadership. It would seem that this profession is in the throes of achieving this level.

It might be noted that professions which are closely allied to recreation and informal education have reached and exceeded the

three emphases described and have accomplished considerable progress in the development of research and the survey of objective data.

Clearly, if the field of recreation and informal education still remained in its early stages with its chief emphases on idealism and specialized programs, then there would be no justification for this study. Since it is apparent that there is good reason to believe that the field has emerged into the later emphasis on "the broadening of objectives, the interchange of professional leadership and achievements, and the acceptance of common sources of educated leadership," there is a need for a standard way to check and evaluate activities of workers and this will become even more necessary as time goes on.

THE PRESENCE OF MANY GENERIC ACTIVITIES AMONG THE SPECIALIZED GROUPS WITHIN THE FIELD

Within the past ten years there have been a number of new organizations and alignments created which support the thesis that there is a generic body of techniques, methods and activities, not only within the field, but between this and other fields such as physical education and social work. This growing appreciation of a common body of techniques and methods throughout the recreation and informal education field makes the use and application of a Master List of Activities, such as developed in this study, increasingly sound and capable of practical application. Within the past ten years such evidence as the following is indicative of this position.

1. Creation of a Section on Social Group Work in the National Conference on Social Work.
2. Establishment of the American Association for the Study of Group Work.
3. Creation of the National Association of Leisure-Time Educators.
4. Organization of the Society of Recreation Workers of America.
5. The addition of the term, "Recreation," in the name of the American Association for Health and Physical Education.
6. Joint sponsorship of conferences by the National Progressive Education Association and the American Association for the Study of Group Work.
7. Discontinuance by The National Council of the Young Men's Christian Association, Boys' Clubs of America, and other organizations, of their schools for educating professional leaders and the present emphasis on an educational program of a general nature, as broad as those created for the teaching and social case work professions.
8. The holding of three National Conferences on the College

Training of Recreation Leaders to make immediate plans for educating skilled workers in leisure-time leadership.

9. The increasing number of special schools or programs for the education of social group workers which have been organized.

THE IMPACT OF CLOSELY ALLIED SOCIAL AND EDUCATIONAL MOVEMENTS

A widespread appreciation of basic activities and duties of leaders and supervisors in recreational and informal education has been made necessary by the impact of closely allied social and educational movements.

Among the social and educational contributions which have influenced the duties performed by leaders and supervisors are: (1) the creative or project emphasis from progressive education; (2) the sociologists' emphasis upon the role of group experience in the development of attitudes and personalities; (3) the development of neighborhood and community coordinating movements; (4) the recreation movement; (5) the field of physical education; and (6) the growth of the mental hygiene movement.

It is apparent that many of the traditional concepts of recreation and the so-called character building agencies have been undermined or rendered obsolete thereby and a new understanding of procedure, methods and practices must be developed.

THE METHODS AND PROCEDURES OF THE INVESTIGATION

The major research method used in the study was an activity analysis. This method was selected after a review of studies in this and allied fields.

The collection and classification of the activity items, which are described in detail in the dissertation, went through two stages and the following general steps:

FIRST STAGE

1. Approximately 1,300 daily activity diaries kept for periods of four to ten days by National Youth Administration youth leaders and supervisors in the State of Ohio were analyzed and the activities extracted.

2. The Ohio National Youth Administration District Directors' administrative monthly reports to the State Director for a full year were examined in order to extract reported activities.

3. Twenty-three books, publications and allied studies, were examined and the activities extracted.

4. Twelve annual reports of Public Recreation Systems and ten reports of semi-public agencies were analyzed.

5. Bulletins and other publications from national agencies, such as the Girl Scouts and Boy Scouts manual, and the Young Men's Christian Association yearbooks were reviewed.

From these sources approximately eight thousand items were carded among which were duplicates, ambiguous statements, and those reported in combinations. Tentative classifications were adopted and the activity items were checked for duplicates and overlapping. At first thirty-six divisions were chosen for tentative classification and all the activities were grouped under these major headings. The divisions which had but a few activities were combined with others until the number of such divisions was reduced to twenty.

The unduplicated activities were combined and recombined until a list of 309 activities remained classifiable under twenty divisions. This list became the Preliminary Master List and a selected group of judges was asked to review the activity items for importance and supplementation.

The need for still further condensation of the Preliminary Master List of activity items and consideration of activities in closely allied fields, such as mental hygiene and social hygiene, became apparent from the reactions and comments of the selected judges and others consulted. Consequently it was decided to tap new sources in addition to the Preliminary Master List in order to develop the revised list. This became the second and final stage of the study and included the following steps:

SECOND STAGE

1. The 309 activity items in the Preliminary Master List were reproduced on cards again in order that they might be supplemented by the activity items to be obtained from new sources.

2. Suggestions received from eighty-eight selected judges for additions to the Preliminary Master List were added on the filing cards.

3. Approximately 100 Works Progress Administration recreation leaders and 20 agency executives supervising them were given an opportunity to add activity items to the Preliminary Master List.

4. Likewise to spot activity items the files of the Education and Recreation Division of the Philadelphia Council of Social Agencies were examined. Material, reports, and programs of approximately seventy-five organizations on the recreation and informal education field are included in these files.

5. Fifteen studies directed by the investigator evaluating the effectiveness of the work of Philadelphia and Baltimore agencies yielded activity items. These agencies included settlements, a Young Women's Christian Association, a Boys' Club, a Boy Scout Council, a Girl Scout Council, community centers, an agency combining the case work and social group work methods, and a city-

wide organization serving negroes.

6. The activity items in the "Guide for Agency Educational Study (1941 Revision)" were carded as were also the activity items which were dropped from the 1941 Revision, and which appeared in the previous three editions.¹

7. Nine additional books and publications from new reading lists were analyzed and the new activity items noted and carded.

The activity items obtained from the above sources were classified in tentative divisions and the items were combined and recombined. The resulting Master List contained sixty-nine activity items which were classified in ten divisions and this list was finally adopted as the accepted list of activities that are performed by leaders and supervisors in the recreation and informal education field. Consequently, this represents the major product of the present study.

THE FINDINGS OF THE STUDY—REVISED OR FINAL MASTER LIST OF ACTIVITIES

The resulting product of the study is in the opinion of the investigator, applicable, with certain modifications, to any community but no attempt has been made to justify the program except in relation to the activities of recreation and informal education leaders and supervisors in Philadelphia.

The activities which follow represent the more important major activities in this field taken as a whole. Furthermore, every activity is being performed to some extent by some leader or supervisor. However, specialized agencies within this field such as the Young Women's Christian Association, Boy Scouts, and others of which mention has already been made, would without doubt, consider certain activities of more importance than others and some duties of little or no importance. Examination of the list of activities will reveal some basic factors which appeared to have influenced the selection of activities. Chief among these are: (1) the democratic way of life appears to be the dominant philosophy influencing the activities of the Master List; (2) the impact of social group work on the general field of recreation and informal education appears to be reflected in increased emphasis on the values of group education especially when the individual and his group relationships are made the focal point; and (3) the contributions of specialized areas and allied fields such as mental hygiene, education, social case work, and others.

REVISED OR FINAL MASTER LIST OF ACTIVITIES PERFORMED
BY RECREATION AND INFORMAL EDUCATION LEADERS
AND SUPERVISORS

DEVELOPING AND PLANNING OF POLICIES AND FUNCTIONS

1. Formulating general aims, objectives and purposes, e. g., studying

¹ Joe Hoffer, compiler, *Guide for Agency Educational Study*, Philadelphia, Council of Social Agencies, 1940.

trends and developments, philosophy, and principles of recreation and informal education, etc.

2. Selecting general methods and techniques for the achievement of aims, objectives, and purposes for the agency; e. g., group work process, democratic process, etc.

3. Studying characteristics of agencies (in which worker is employed); e. g., gaining a basic understanding of my agency, its place in the community, its purposes and program, etc.

4. Studying broad or general characteristics of neighborhood or community; e. g., population, social and economic conditions, etc.

5. Studying specific characteristics of recreation and informal education in community or neighborhood; e. g., interests of the neighborhood or the community members in leisure-time activities, kind of participation in leisure-time activities, etc.

6. Selecting activities and programs to be planned; e. g., studying available data and resources, examining objectives and goals, etc.

7. Selecting specific methods and techniques for the achievement of aims, objectives, and purposes for groups; e. g., preparation for group meetings, etc.

8. Selecting specific activities and programs for group; e. g., stimulating group projects as well as individual projects, helping the group look ahead and plan a long-term program of activities, etc.

9. Analyzing contributions of allied and specialized fields; e. g., case work, education, etc.

Other (specify).

ACTIVITY PROGRAM AND SKILLS

1. Guiding informational activities; e. g., those whose major purpose is educational, such as discussion, other language utilization activities, etc.

2. Teaching physical activity skills; e. g., sports (high organization), low organization games, etc.

3. Teaching dramatic activity skills, e. g., personal dramatizations, play production, etc.

4. Teaching music activity skills; e. g., vocal activities, instrumental activities, etc.

5. Teaching explorative activity skills; e. g., nature enjoyment and study, outdoor activities, etc.

6. Teaching arts and crafts activity skills; e. g., leisure arts, handcraft, home-making activities, use of tools, etc.

7. Guiding social recreation activities; e. g., activities whose major purpose is fun, the providing of a good time, social dances, etc.

8. Overseeing informal play and unorganized activities; e. g., play or game room activities, door and hall duty, etc.

Other (specify).

HEALTH AND SAFETY

1. Overseeing and guiding participants' health and physical efficiency; e. g., persuading individuals to seek well qualified medical services, prescribing corrective gymnastics, etc.

2. Having responsibility for accident prevention; e. g., preventing accidents, protecting participant from physical hazards, etc.

3. Dispensing first aid and emergency treatment; e. g., applying emergency treatment, etc.

4. Constructing health units for teaching; e. g., outlines for discussion, talks, etc.

5. Conducting mental health program in group and / or agency; e. g.,

emphasizing an effective philosophy of life, interest and satisfaction in one's work, proper use of leisure, etc.

6. Conducting social hygiene program in group and/or agency; e. g., talks to members and community groups on problems of syphilis and gonorrhea, educational meetings with representatives of allied fields on integrating services, etc.

7. Promoting good health measures in community; e. g., assisting in educating community for health, taking part in health and safety drives, campaigns, etc.

8. Conducting health and safety meetings; e. g., nutrition, first aid, etc.
Other (specify).

COUNSELING, GUIDING, AND PERSONAL SERVICE

1. Diagnosing and analyzing individual difficulties and needs; e. g., identifying some basic behavior patterns displayed by members (alibi, sense of inferiority, daydreaming), recognizing basic causes of behavior difficulties, etc.

2. Counseling individuals with discipline problems, e. g., checking and adjusting complaints, removing cause of friction between individuals, etc.

3. Counseling individuals with delinquency and crime problems; e. g., referring boy to proper authorities, providing special opportunities for pre-delinquent to participate in program, etc.

4. Counseling individuals with leisure-time and recreation problems; e. g., expanding and widening members' interests in many different types of activities, referring individual to other agencies, etc.

5. Counseling individuals with social problems; e. g., assisting individual to assume normal social relations, analyzing causes of lack of social contacts, etc.

6. Counseling individuals with vocation problems; e. g., assisting individuals to analyze aptitudes, discussing placement possibilities, etc.

7. Counseling individuals with education problems; e. g., assisting individuals to make plans for further education, making proper referrals to education authorities, etc.

8. Interviewing; e. g., intake and referrals, etc.

Other (specify).

RELATIONSHIPS AND COOPERATION

1. Having relationships and cooperating with individuals; e. g., parents, agency members, and community members, etc.

2. Having relationships and cooperating with other local agencies and organizations; e. g., maintaining cooperative relationships with schools, social agencies, churches, etc.

3. Having relationships and cooperating with state and national organizations; e. g., conferences, Boys' Clubs of America, etc.

4. Having relationships with public; e. g., interpretation, publicity, etc.

5. Participating in or directing social action; e. g., legislation supporting unions and other social movements, etc.

Other (specify).

RECORDING AND REPORTING

1. Organizing and revising system of records and reports to meet the needs of an organization or agency; e. g., administration, planning, etc.

2. Recording and reporting information about individuals; e. g., membership, case records, etc.

3. Recording and reporting information about groups; e. g., program, group development records, etc.

4. Compiling and preparing general report; e. g., assembling statistics, monthly and annual reports, etc.

Other (specify).

RESEARCH AND EXPERIMENTATION

1. Preparing standards and criteria for use in research and experimentation; e. g., to list quality of program, growth of individual, etc.

2. Selecting methods and techniques to be used in research; e. g., activity analysis, case method, etc.

3. Preparing schedules and forms for recording or reporting data; e. g., about individuals, groups, etc.

4. Assembling and interpreting data pertaining to such activities; e. g., as management of finances, personnel, etc.

5. Assembling, analyzing, and interpreting data about individuals; e. g., individual growth, change in personality, etc.

6. Assembling, analyzing, and interpreting data about groups; e. g., degree to which objectives have been achieved, degree to which standards of performance have been maintained, etc.

7. Assembling and interpreting data about agency; e. g., its purposes, program, etc.

8. Conducting new programs or activities for demonstrational purposes; e. g., those whose primary purpose is to meet a new or unique need.

Other (specify).

PERSONNEL

1. Guiding general pre-service and in-service education programs; e. g., staff meetings, conferences, etc.

2. Making job studies; e. g., job categories, definitions, qualifications, etc.

3. Recruiting and selecting personnel (volunteer and paid); e. g., securing applicants, applications, and recommendations, etc.

4. Planning work, directing and being responsible for staff organization and inter-relationships (volunteer and paid); e. g., determining functions of personnel, setting up employment procedures, personnel practices, etc.

5. Counseling present staff and maintenance employees on individual problems; e. g., developing morale and harmonious relationships, etc.

6. Furthering self-improvement and professional advancement; e. g., improving leadership methods and techniques, participating actively in professional and cultural organizations of the community, etc.

Other (specify).

PHYSICAL PLANT, EQUIPMENT, AND MATERIALS

1. Overseeing general facilities; e. g., household, gymnasium, etc.

2. Overseeing service systems; e. g., heating and ventilating, lighting, etc.

3. Operating special equipment and facilities; e. g., movie projector, violet ray, etc.

4. Consulting with architect or contractors on designing and constructing play areas, facilities, etc.

Other (specify).

ADMINISTRATION AND FINANCE

1. Assuming major responsibility for carrying out directions and recommendations of advisory groups; e. g., making necessary arrangements for formation of committees, general meetings, etc.

2. Guiding and assisting with committees and councils; e. g., conferring with individuals on general programs working with inter-group councils, etc.

3. Directing the staff, having responsible charge of, and / or being responsible for activity program; e. g., determining plan of activities, working out plans in detail for various agency units, etc.

4. Having responsible charge of, and / or being responsible for groups;

e. g., aiding group in its process of organization; conferring with individuals on general programs, arranging for meeting places, speakers, etc.

5. Directing maintenance staff, having responsible charge of and / or being responsible for physical plant, facilities, and equipment; e. g., determining use of activities, maintaining clean and orderly conditions of physical facilities, equipment, etc.

6. Planning work, directing the staff, having responsible charge of and / or being responsible for office routines; e. g., files and filing, organizing and managing office routine, etc.

7. Utilizing records and control systems; e. g., reports to increase efficiency, supervisory records, etc.

8. Planning and having responsible charge of, and / or being responsible for finances; e. g., budget, financial and cost accounting, etc.

9. Recruiting members or participants; etc.

Other (specify).

POSSIBLE APPLICATIONS OF THE MASTER LIST

The Master List is a very flexible instrument and a single point of view or different points of view can find expression and yet will provide a generic or basic interpretation of the final results. Individuals or agencies using the Master List will find the list reasonably complete because of the comprehensiveness of the sources tapped in the compilation of activity items and the many opportunities for supplementation by selected judges and groups. Therefore it is not likely that many major activity items would be added to the list; nevertheless an occasional one may be found, which may be unique or unusual. Individuals and groups would be wise to add any additional items which they think should be included for their own purposes.

Five possible applications are presented and demonstrated in the study. These are:

1. Evaluation of the Activity Items.
2. Standardization of Operative and Administrative Procedures.
3. The Selection and Assignment of Personnel.
4. Measurement of Individual and Agency Efficiency.
5. Formulation of an In-Service Education or Staff Development Program.

SELECTED MATERIALS AND REPORTS FOR USE IN THE APPLICATION OF THE MASTER LIST

1. *An Activity Analysis of the Duties of Recreation and Informal Education Leaders and Supervisors*, 1942, 130 pp., Bibliography, \$1.00. A description of the methods and techniques utilized in developing the Master List, illustrations for use of List.

2. *Manual of Directions for Statistical use of the Master List*, 1942, 6 pp. Instructions for tabulating the judgments by hand and by Hollerith's machine.

A Study of the Sit-up Type of Test As a Means of Measuring Strength and Endurance of the Abdominal Muscles

BY R. T. DEWITT
*Louisiana State University
Baton Rouge, Louisiana*

INTRODUCTION

IN the present war emergency more stress than ever before is being placed on physical fitness and means of more accurately testing for it. A device used in an attempt to determine a phase of fitness is the sit-up type test. Tests of this type are often spoken of as tests of abdominal muscular strength and endurance.

In administering the sit-up type tests in physical fitness classes the writer observed quite frequently that certain men who demonstrated much better than average ability in tests of arm strength, endurance, and cardiovascular efficiency, were not able to approximate average performance in doing the sit-up type tests. This raised a question in the writer's mind as to whether the sit-up type of test really measured strength and endurance of the abdominal muscles. The study herein reported grew out of the desire to investigate this question.

THE PURPOSE OF THE STUDY

The purpose of this study was to determine the degree which different tests of the sit-up type correlate with criteria of abdominal-muscle strength and endurance and how these same tests correlate with each other.

PROCEDURE FOLLOWED

The first step in the investigation was to set up criteria of abdominal strength and endurance. In order to determine the strength of the abdominal muscles, a dynamometer was used to measure in pounds the power of the abdominal muscles to pull the trunk toward a sitting position. To be tested the subject lay on a table with his shoulders extended over one end. One end of the dynamometer was anchored to the floor beneath the subject's head. A strong leather belt was inserted through the other end of the dynamometer and extended up under one arm pit, across the chest of the subject, down under the other arm and returned to the dynamometer. An assistant held the man's ankles in contact with the table throughout the test. The dynamometer reading made when the subject attempted to raise to a sitting position was taken as his abdominal strength in pounds.

In establishing a criterion for abdominal-muscle endurance, a test was devised which kept the abdominal muscles in continuous contraction while supporting the weight of the trunk. The test was started with the subject lying on the floor, his feet on the floor under the bottom rung of a set of stall bars, and his hands clasped back of his head. At a signal he raised his body from waistline up completely clear of the floor and kept it so as long as possible. His score was the number of seconds his back remained off the floor.

The second step in the study was to give three different tests of the sit-up type to a random sampling of 102 boys from the physical fitness classes at Louisiana State University. The tests were administered over a period of five weeks. One test was given at each mid-week meeting of the class.

In the first test the subject started while lying on his back. To do a sit-up he raised to a sitting position and touched an elbow to the opposite knee. Without resting he returned to the starting position. He then raised to another sit-up and touched the other elbow to the opposite knee. The feet were not held but the subject was not allowed to raise the heels until the back was completely clear of the floor.

In the performance of the second test the subject's feet were held to the floor by an assistant. He started in a sitting position, hands clasped back of the head. In performing a sit-up the subject lowered the torso and, with back arched, touched only his head or his clasped hands to the floor, raised forward to a sitting position and touched an elbow to the opposite knee. No pause was permitted during any part of the cycle.

The third test was performed in a manner similar to that employed in doing the first except that the feet were held and the subject's score was the number of sit-ups he could do in two minutes.

Each man was weighed and his height measured on the day the first test was administered. The writer was interested in determining the relationship, if any, which might be found between size and the ability to perform the sit-up type of test, and so included the items of height and weight in the data collected.

By using the Pearson Product-Moment Method the three tests and the items of height and weight were correlated with each other. The mean and standard deviation were found for each one of the groups of scores.

FINDINGS

The results indicate that the correlation between the ability to perform tests of the sit-up type and abdominal strength and endurance is relatively low. Table I shows that test two which involved the arched back position had the highest coefficient of correlation of the three with abdominal strength.

TABLE I
COEFFICIENTS OBTAINED BY CORRELATING CRITERION SCORES
WITH THOSE OF THE VARIABLES

Criteria	Variables				
	Test 1	Test 2	Test 3	Weight	Height
Abdominal Strength	.040	.157	.142	.281	.256
Abdominal Endurance	.245	.370	.257	.093	.155

In Table I it is revealed that the three tests were found to correlate higher with the criterion of abdominal muscle endurance than with that of abdominal strength. It is seen also that weight and height are more definitely related to strength than to endurance though in neither case is the relationship significant. In Table II it is noted that the most significant intercorrelation was that of tests one and three, the coefficient being .556.

TABLE II
COEFFICIENTS OF INTER-CORRELATIONS

	Abdominal Strength	Abdominal Endurance	Test 1	Test 2	Test 3	Weight
Abdominal Endurance	.108					
Test 1	.040	.245				
Test 2	.157	.370	.352			
Test 3	.142	.257	.556	.142		
Weight	.281	.093	-.069	.281	-.047	
Height	.256	.155	.130	.256	-.038	.611

As shown by Table II correlations of the three tests and abdominal strength and endurance with each other were all positive; yet when these tests were correlated with weight and height three coefficients were negative and the other seven very low. This seems to indicate that there is little if any relationship of tests of abdominal strength and endurance with weight and height.

TABLE III
THE MEANS, STANDARD DEVIATIONS, AND RANGE OF THE SCORES ACHIEVED

	Mean	Standard Deviation	High Score	Low Score
Strength	179.66 Lbs.	41.11 Lbs.	270 Lbs.	61 Lbs.
Endurance	57.25 Secs.	19.82 Secs.	125 Secs.	18 Secs.
Test 1	50.84	29.04	133	3
Test 2	20.75	14.15	75	0
Test 3	57.29	8.39	76	31
Weight	141.99 Lbs.	18.23 Lbs.	206 Lbs.	115 Lbs.
Height	68.5 Ins.	2.5 Ins.	75 Ins.	62 Ins.

Table III was included for the benefit of readers who might be interested in the nature of the scores achieved by the subjects used in the study.

CONCLUSIONS

The findings of this study indicate that:

1. There is a definite question as to the justification for calling

the sit-up type test a test of strength and endurance of the abdominal muscles.

2. Size appears to bear little relationship to strength and endurance of the abdominal muscles as measured in this study.

3. Strength and endurance do not appear to be significantly related so far as the abdominal muscles are concerned.

4. Heavier and taller men appear to be handicapped in performing tests of the sit-up type.

A Comparison of Five Methods Designed to Predict the "Normal" Weight of College Women

By MARGARET BELL CRAIG
College of Charleston
Charleston, S. C.

THE purpose of the study was to determine the amount of agreement among five methods of estimating the expected weight of college women when they are applied to the same individuals. The five methods to be examined were (1) the Medico-Actuarial Mortality Investigation age-height-weight standards,^{2*} (2) the revised Pryor width-weight tables,¹⁹ (3) the Boillin weight expectancy regression equation,⁵ (4) the McCloy method for appraising physical status,¹⁴ and (5) the Ludlum method of weight prediction for college women.¹¹

The subjects were 101 girls between the ages of seventeen and twenty-two. They were drawn at random from two Wellesley College dormitories, and may be considered as typical of Wellesley College students.

The measurements were taken in accordance with the descriptions given by the respective authors. They were obtained on each individual by each of two trained examiners measuring independently. The measurements were recorded by a third person who asked to have them repeated when the discrepancy between the results of the two examiners exceeded the amounts indicated below:

<i>Measurement</i>	<i>Allowed Differences</i>
Height	2mm.
Chest girth	1 cm.
Bi-acromial width	1 cm.
Bi-iliac width	1-2mm.
Knee width	1mm.
Chest depths (two)	2-3mm.
Chest widths (three)	3-4mm.
Upper arm girth	3mm.
Forearm girth	2mm.
Thigh girth	5-6mm.
Calf girth	1-2mm.
Bi-trochanteric width	3-4mm.
Fats	1mm.

This is an abstract from a thesis submitted in partial fulfillment for the degree of Master of Science in Hygiene and Physical Education at Wellesley College, by Margaret Ould Bell, June 1941. The author is on leave of absence from the College of Charleston.

* Superior figures refer to numbered bibliography at end of article.

METHODS DESIGNED TO PREDICT THE "NORMAL" WEIGHT 65

Chest front
Chest back

Abdominal
Supra-iliac

A single value for each measurement was found for each individual by taking the mid-value of the two measurements of the examiners.

For each of the five methods, the expected weight for each girl was found and converted into a percentage index of actual weight relative to expected weight.

Weight of the subject was considered as within the normal zone for a given method if the percentage index was between 95.0 and 109.9. If the index was 94.9 or less, the subject was considered "underweight"; if 110.0 or above, she was classified as "overweight."

AGREEMENT AMONG THE METHODS

A. NUMERICAL AGREEMENT

The first approach was made in terms of the numerical agreement existing among the classifications made by the five methods. In Table I is shown the number of cases classified as underweight, normal weight, and overweight by each method.

TABLE I
CLASSIFICATION OF SUBJECTS AS UNDERWEIGHT, NORMAL WEIGHT, OR
OVERWEIGHT BY EACH METHOD

Method	Underwt. 94.9 or below	Normal Wt. 95.0-109.0	Subjects Overwt. 110.0 and above	Mean Index	S. D. of Index
Pryor	56	42	3	94.6	7.1
Height-Weight	21	58	22	102.5	9.7
Ludlum	21	61	19	102.4	8.1
McCloy	24	72	5	99.4	6.2
Boillin	12	69	20	103.9	7.2

It may be noted that over half of the subjects are classified as underweight by Pryor; about one-quarter are classified as underweight by height-weight, Ludlum, and McCloy, while about one-eighth are so classified by Boillin. The number of those classified as normal ranges from seventy-two by the McCloy method to forty-two by the Pryor method; and the overweight group ranges from twenty-two by the height-weight method to three by the Pryor method.

The mean index for Pryor is much lower than for the other methods. The range is from Pryor, 94.6, to Boillin, 103.9.

To determine to what extent the same cases were placed in the same classification by the various methods, each of the figures in the first three columns of Table I was analyzed. The results of this analysis are shown in Table II.

It is evident from this tabulation that there is a fairly large number of subjects on whom the five methods are not in agreement. The maximum agreement is between the Ludlum and Boillin meth-

ods, which give the same classification to seventy-nine cases. The number of cases on which any pair of the methods agree is as follows:

Ludlum-Boillin	79
Ludlum-Height-Weight	74
Height-Weight-McCloy	71
Boillin-McCloy	68
Height-Weight-Boillin	66
Ludlum-McCloy	66
Pryor-McCloy	65
Pryor-Ludlum	51
Pryor-Height-Weight	48
Pryor-Boillin	43

The number of cases placed in the same classification by all the methods, four or more of the methods, and three of the methods is shown below:

	All Methods	Four or More Methods	Three or More Methods
Underweight	6	13	23
Normal Weight	18	43	65
Overweight	2	5	13
	<hr/> 26	<hr/> 61	<hr/> 101

It may be noted that at least three methods were in agreement for every subject, four are in agreement for sixty-one, but only twenty-six subjects are placed in the same zone by all five methods.

B. CORRELATIONAL ANALYSIS

To measure further the degree of relationship among the methods, the coefficient of contingency was computed for the three zone classifications by each pair of methods. The rather striking differences in the way in which the same subjects were classified by the various methods is shown by the fact that the lowest coefficient (between height-weight and McCloy) is .42 while the highest (between height-weight and Ludlum) is .70. The possibility was considered that these low coefficients of contingency were due not so much to differences in the form of the distributions as to differences in levels at which the zones divided the various distributions. To test this hypothesis, product-moment correlations between the numerical indices rather than the three weight classifications were computed. The coefficients of contingency for the three zone classifications and the zero order correlations between pairs of methods are shown below:

<i>Pairs of Methods</i>	<i>C</i>	<i>r</i>
Height-Weight-Ludlum	.70	.87
Ludlum-Boillin	.67	.86
Pryor-McCloy	.55	.76
Pryor-Ludlum	.55	.77
McCloy-Boillin	.53	.72
Height-Weight-Boillin	.52	.70

TABLE II
 AGREEMENT AND DISAGREEMENT OF THE FIVE METHODS IN THE CLASSIFICATION OF THE SUBJECTS AS UNDERWEIGHT, NORMAL WEIGHT,
 OR OVERWEIGHT

A. Underweight											
Method	No. Underwt.	Classification by Each Method of Those Subjects Designated as Underweight by a Given Method									
		Pryor		Ht.-Wt.		Ludlum		McCloy		Boillin	
		U	N** O***	U	N O	U	N O	U	N O	U	N O
Pryor	56			21	34 1	21	34 1	24	32	12	41 3
Height-Weight	21			21		17	4	10	11	7	14
Ludlum	21			17	4	21		13	8	10	11
McCloy	24			10	14	13	11	24		10	14
Boillin	12			7	5	10	2	10	22	12	
B. Normal Weight											
Method	No. Normal wt.	Classification by Each Method of Those Subjects Designated as Normal Weight by a Given Method									
		Pryor		Ht.-Wt.		Ludlum		McCloy		Boillin	
		U	N O	U	N O	U	N O	U	N O	U	N O
Pryor	42			24	18	27	15	39	3	28	14
Height-Weight	58			58		4	50 4	14	43 1	5	46 7
Ludlum	61			4	50 7	61		11	49 1	2	54 5
McCloy	72			11	43 18	8	49 15	72		2	54 16
Boillin	69			14	46 9	11	14 54	14	54 1	69	
C. Overweight											
Method	No. Overwt.	Classification by Each Method of Those Subjects Designated as Overweight by a Given Method									
		Pryor		Ht.-Wt.		Ludlum		McCloy		Boillin	
		U	N O	U	N O	U	N O	U	N O	U	N O
Pryor	3										
Height-Weight	22			22		7	15	18	4	9	13
Ludlum	19			4	15	19		15	4	4	15
McCloy	5			1	4	1	4	5		1	4
Boillin	20			7	13	5	15	16	4	20	

* Underweight.

** Normal weight.

*** Overweight.

Height-Weight-Pryor -----	.51	.83
Ludlum-McCloy -----	.51	.74
Pryor-Boillin -----	.43	.76
Height-Weight-McCloy -----	.42	.70

In every case the product-moment coefficient is significantly greater than the coefficient of contingency. This suggests that at least part of the disagreement among the methods may be due to differences in the level of the means of the five distributions, which would affect the per cent of cases falling within the normal zone of 95.0 through 109.9.

Each method was also correlated with a weighted criterion consisting of the other four methods. The results are as follows:

<i>Method</i>	<i>R</i>
Ludlum -----	.94
Height-Weight -----	.92
Boillin -----	.90
Pryor -----	.89
McCloy -----	.80

C. DISCUSSION

From Tables I and II and the tabulation preceding Table II it may be seen that there is considerable disagreement in the classifications made by the five methods. However, with the exception of four cases classified as underweight by Pryor, a case classified in a given zone by one method is either in the same or an adjacent zone by the other methods; i. e., a case underweight by one method is either underweight or in the normal zone by each of the others; or a case overweight by one method is either overweight or in the normal zone by each of the others.

It is difficult to see why such a large number of the subjects in this study are classified as underweight by the Pryor method. The most obvious explanation would be that the sample used by Pryor was not comparable to that used in the present study either in nutritional status or perhaps in body build. The present findings would seem to indicate that the average weight of the California sample used by Pryor was greater than that of the Wellesley group, and also greater than that of the samples used in formulating the height-weight, Ludlum, McCloy, and Boillin standards. This is possible but seems unlikely considering the nature of the samplings. Pryor's subjects were college women. Ludlum's subjects were drawn from seventeen colleges and universities having a wide geographical distribution. McCloy's subjects were Iowa college women, and Boillin's were drawn from Wellesley College, which in turn draws its students from a wide geographical area.

While it is possible that more than half of the girls in Wellesley College are actually underweight, this does not seem likely. These

girls come from the upper socio-economic levels; their diet is carefully regulated by a corps of trained dieticians, and they are under constant medical supervision.

The coefficients of correlation between pairs of methods are higher than the corresponding coefficients of contingency. From this relationship it would seem that the similarity between the index distributions is closer than the correspondence between the zone classifications. This would follow from the fact that the means for the indices derived from the various methods are significantly different. For example, in the Pryor distribution the mean is 94.6, and fifty-six cases fall below 95.0. In the height-weight distribution, the mean is 102.5 and twenty-one cases fall below 95.0. But the order of the cases within the two distributions is roughly similar, as indicated by the correlation coefficient of .83.

It is seen that the highest correlation, .87, is found between the height-weight standard and the Ludlum method. These are the simplest of the five methods, Ludlum adding to height only a measure of the size of the chest. The lowest correlation, .70, is between the height-weight standard and the Boillin method, and the height-weight standard and the McCloy method. Boillin and McCloy are the two most complicated standards of the study. In addition to height Boillin uses shoulder, chest, and hip measurements. McCloy adds to height measurements of the chest, hip, and knee, as well as fat measurements for correction of the chest and hip measures. The coefficients of correlation of Pryor with the other four methods are intermediate in value. Pryor adds a hip and a chest measurement to height and is more complex than the height-weight and Ludlum standards, yet simpler than the Boillin and McCloy techniques.

In examining the multiple correlations of each method with the combination of the other four methods (refer to section immediately preceding "Discussion") it should be remembered that the criterion is not a constant one. The order of magnitude of the correlations is approximately that which might be expected from a study of the measurements used in each method. Height is common to all five techniques. The Ludlum method uses chest measurements in addition to height. Similar chest measurements are found in each of the weight-for-build methods. The Pryor method has height in common with all the other methods, a chest measurement in common with Ludlum, Boillin, and McCloy, and a hip measurement in common with Boillin and McCloy. Boillin uses a shoulder measurement in addition to the height, chest, and hip measurements. McCloy introduces the greatest number of unique elements, a correction for fat and a knee measurement.

EVALUATION OF METHODS

The approach to the "evaluation" of the methods should be made with the realization that there is no absolute criterion of underweight, normal weight, and overweight against which to evaluate the methods.

One possible criterion is suggested by the fact that for every subject at least three methods were in agreement. If this majority opinion be considered as "correct," then each method may be evaluated by determining in how many cases it agrees with this majority opinion.

A second evaluation may be made in terms of deviations in the amount of soft tissue of an individual. Theoretically that part of the weight made up of the skeleton and viscera is relatively constant in the adult and is not subject to nutritional change. The increase or decrease in an individual's weight is accomplished by changes in the soft tissues, principally the muscles and fat. In contrast to the skeletal and visceral components of the body, these factors are not constant but subject to change through diet and exercise.

The percentage index of $\frac{\text{actual weight}}{\text{expected weight}}$ measures the per cent deviation of the weight of the individual from that expected or average for his bony structure. If such deviations are determined principally by differences in the amount of fat or muscle, then that method which is most closely related to the amount of fat and muscle would seem to be the most valid measurement of "underweight," "normal weight," or "overweight."

With these considerations in mind, an attempt was made to "evaluate" the five methods in terms of each of the suggested criteria.

CONSENSUS CRITERION

The indices for each girl were studied to determine how she was classified by a majority of the methods. The classifications given by each of the methods were compared with this consensus criterion. The agreement of the methods with the criterion on the 101 subjects is as follows:

Ludlum	93
Boillin	83
Height-Weight	82
McCloy	74
Pryor	58

From this tabulation, it would appear that the Ludlum method is the most successful in classifying college women in accord with the consensus criterion, agreeing with it for ninety-three cases, and disagreeing on eight. It is interesting to note that the height-weight

classification agrees with the consensus criterion on eighty-two cases, the agreement being better than that achieved by McCloy and Pryor, and as good as that shown by Boillin.

SOFT TISSUE CRITERION

The norms proposed by McCloy were used and the expected limb girths for upper arm, forearm, thigh, and calf were computed for each individual.¹⁵ The actual measurement of each girth was divided by the corresponding expected measurement to obtain an index of the actual muscular development. An average of these four indices gave the percentage index of total muscular development. The percentage index of total fat was also computed for each individual according to the formula of McCloy based on chest front, chest back, abdominal, and supra-iliac fat. A second fat index, that of hip difference, was likewise found according to McCloy. These three indices, of body fat, hip difference, and muscular development, were used as a basis for determining the efficacy of the five weight indices in measuring the relative amounts of soft tissue for each individual.

The range of the indices for limb girth or muscular development was from 93 to 117, with a mean of 106.8. The lower limit is set by McCloy as 97 per cent. Only one case was below this norm.

The range of the indices for total fat was from -75.7 to $+135.1$, with a mean of $+1$. The normal zone, according to McCloy, is -33 per cent to $+66$ per cent. There were nineteen cases below and eight above normal.

The range of the indices for hip difference was from -169.6 to $+226.1$ with a mean of $+54.6$. No normal zone has been established for this measurement, but there were twenty-two below zero, three at zero, and seventy-six above zero.

It is seen that only one case falls below the normal limit of limb girth deviation, whereas twenty-seven cases fall outside of the normal zone of the fats. This fact coupled with the wide range of deviation in hip difference indicates that the subjects in this study are of normal muscular development but show variations in the amount of subcutaneous tissue.

The intercorrelations for fat, hip difference, and limb girths are shown below:

	<i>Limb Girths</i>	<i>Fats</i>
Fats -----	.21	
Hip difference -----	.33	.53

Tri-serial correlations were computed between the weight classification by each method and limb girths, fats, and hip difference. These results are shown in the following tabulation:

<i>Method</i>	<i>Limb girth</i>	<i>Fats</i>	<i>Hip difference</i>
Pryor -----	.58	.56	.74
Height-Weight -----	.49	.77	.62
Ludlum -----	.67	.57	.53
McCloy -----	.81	.58	.74
Boillin -----	.66	.44	.60

It may be noted that two of the methods, Pryor and height-weight, have their highest correlation with a fat measurement; Pryor, .74 with hip difference; and height-weight, .77 with the four fats. The other three, Ludlum, McCloy, and Boillin, correlate more highly with the muscular development, Ludlum, .67; McCloy, .81; and Boillin, .66.

The multiple correlation of each method with a combined criterion of the three measurements, fats, hip difference, and limb girths was computed. The results are seen in the following tabulation:

<i>Method</i>	<i>R</i>	<i>Predictive Index</i>
McCloy -----	.97	76
Height-Weight -----	.86	49
Pryor -----	.84	46
Ludlum -----	.81	41
Boillin -----	.78	37

The multiple correlation of the McCloy method with the combined criterion of fats, hip difference, and limb girth, .97, is significantly greater than that obtained with any other method. The next highest multiple correlation is obtained with the height-weight standard, .86. It would seem, therefore, that within the limits of the validity of the soft tissue criterion, the McCloy method is the most accurate indicator of relative nutritional status for the subjects used in this study. It is interesting to note that with reference to this soft tissue criterion, the height-weight method has a slightly higher predictive value than do the other more complex weight-for-build methods.

SUMMARY AND CONCLUSIONS

The expected weight of 101 Wellesley College women between the ages of seventeen and twenty-two was determined by the Medico-Actuarial Mortality Investigation age-height-weight tables, the revised Pryor width-weight tables, the Boillin weight expectancy regression equation, the McCloy method for appraising physical status, and the Ludlum method of weight prediction for college women.

The subjects were classified as underweight, normal weight, or overweight by each method according to the percentage deviation from the expected weight of each method.

After the above classifications were made, the following analyses were computed:

METHODS DESIGNED TO PREDICT THE "NORMAL" WEIGHT 73

1. Amounts of agreement and disagreement among the classifications made by the various methods.
2. Coefficients of contingency between pairs of the methods in their classification of the subjects into the weight zones.
3. Product-moment coefficients of correlation between the indices derived by each method.
4. Multiple correlation of each method against the combined criterion of the other four methods.
5. Evaluation of each method against (a) a consensus criterion which assumed that the classification of a subject made by a majority of the methods was "correct," (b) a soft tissue criterion, of fats, of hip difference, and of limb girths.

On the basis of the above analyses, the following conclusions appear justified:

1. The five methods disagree on the classification of the same group of college women as underweight, normal weight, or overweight to such an extent that the methods should not be used interchangeably.

2. The difference between methods is due in part to a difference in the level of the mean of the percentage indices for each method.

3. Against the consensus criterion the Ludlum method appears to be the "best" method. Against the soft tissue criterion, the McCloy method has the greatest accuracy of prediction.

Since the Ludlum method is the simpler of the two techniques, it is recommended that this method be used in situations where time and equipment are important factors for consideration. However, the McCloy method includes an evaluation of the subcutaneous tissues and muscular development of the individual. Therefore, it is suggested that this method be used whenever possible.

4. The height-weight standard shows higher agreement with some of the more complex methods than do these more complicated methods with one another. Against the consensus criterion it is third in accuracy of prediction, and against the soft tissue criterion it is second.

5. Since the Pryor method classifies more than half of the cases as underweight, it does not appear to be applicable to Wellesley College women.

BIBLIOGRAPHY

1. Allman, D. I., "A Comparison of Nutritional Indices," *Research Quarterly*, 8:2, (May, 1937).
2. Association of Life Insurance Medical Directors and The Actuarial Society of America. Medico-Actuarial Mortality Investigation. Vol. I, Table IX, 1912. Printed by the Mary Hemenway Alumnae Association of the Department of Hygiene, Wellesley College, with the permission of the Massachusetts Mutual Life Insurance Company.

3. Baker, S. J., and J. L. Blumenthal, "Methods of Determining Malnutrition," *The Nation's Health*, 5:1, (Jan., 1923).
4. Baldwin, B. T., "Weight-Height-Age Standards (Nude) in Metric Units," Translated and extended from the Baldwin-Wood tables in the English system of measurement. Iowa City, Iowa, Child Welfare Research Station, State University of Iowa, 1924.
5. Boillin, M. L., *Determination of the Interrelations, Partial and Multiple, Between Various Anthropometric Measurements of College Women*. (New York: Teachers College, Columbia University, Bureau of Publications, 1930).
6. -----, "A Study of the Anthropometric Measurements of College Women," *Research Quarterly*, 3:2, (May, 1932).
7. Clark, Taliaferro, Edgar Sydenstricker, and S. D. Collins, "Indices for Nutrition; Application of Certain Standards of Nutrition to 506 Native White Children Without Physical Defects and With Good or Excellent Nutrition as Judged from Clinical Evidence," *Public Health Reports*, U. S. Public Health Service, v. 38, Part I, no. 23, Washington, Superintendent of Documents, June 8, 1923.
8. Hardy, M. C., and C. H. Hoefler, *Healthy Growth* (Chicago: University of Chicago Press, 1936).
9. Jenkins, R. L., "On a Distortion Embodied in the Pryor-Stolz Width-Weight Tables," *Medical Record*, 146:3, (Aug., 1937).
10. Lucas, W. B., and H. B. Pryor, "Physical Measurements and Physiologic Processes in Young Children," *Journal of the American Medical Association*, 97:16 (Oct. 17, 1931).
11. Ludlum, F. E., *The Prediction of Body Weight for College Women*. (Master's Thesis, Wellesley College, 1939).
12. -----, and Elizabeth Powell, "Chest-Height-Weight Tables for College Women," *Research Quarterly*, 11:3 (Oct., 1940).
13. Marshall, E. L., "A Comparison of Four Current Methods of Estimating Physical Status," *Child Development*, 8:1 (Mar., 1937).
14. McCloy, C. H., "Appraising Physical Status: The Selection of Measurements." *University of Iowa Studies. Studies in Child Welfare*, 12:2 (Iowa City: University of Iowa Publications, 1936).
15. -----, "Appraising Physical Status: Methods and Norms." *University of Iowa Studies. Studies in Child Welfare*, 15:2 (Iowa City: University of Iowa Publications, 1938).
16. Pryor, H. B., and H. R. Stolz, "Determining Appropriate Weight for Body Build," *Journal of Pediatrics*, 3:4 (Oct., 1933).
17. -----, C. E. Shepard, and R. O. Moody, "Determining Appropriate Body Weight in Relation to Body Build," *Journal Lancet*, 56:12 (Dec., 1936).
18. -----, *Width-Weight Tables*. For boys and girls from 1 to 16 years; for men and women from 17 to 24 years. (Stanford University, Calif.: Stanford University Press, 1936).
19. -----, *Width-Weight Tables*. For boys and girls from 1 to 17 years; for men and women from 13 to 41 years. (Stanford Univ., Cal.: Stanford Univ. Press, 1940).
20. Souther, S. P., M. M. Eliot, and R. M. Jenss, "A Comparison of Indices Used in Judging the Physical Fitness of School Children," *American Journal of Public Health*, 39:5 (May, 1939).
21. Stix, R. K., and C. V. Kiser, "Relation of 'Correct' Weight and Blood Findings to Physicians' Estimates of Nutrition of School Children," *Jour. Pediatrics*, 5:6 (Dec., 1934).

Speed Sit-ups

By FRANK J. HAVLICEK
1st Lt., Air Corps

*Director of Physical Training
56th AAFTTD (Meteorology)
State University of Iowa*

AT present there is a constant challenge to better the much publicized sit-up performances made by service men and students throughout the world. The present record is well over five thousand, and at this writing may already be exceeded. The value of such performances has been discussed both pro and con, but no definite opinions have been set down because of the relatively few exceptional performers involved. The fact remains however, that many of these records are stimulated by the Army and Navy physical fitness tests and have helped considerably in maintaining enthusiasm for the tests.

Most of the standards for the armed forces sit-up tests run from about 114 to 205 to obtain a 100 percentile score for the individual being tested. This maximum is no effort at all for many of the better conditioned men but still limits their performance even though they could continue the exercise ten times as long. Although, as mentioned before, the participants sometimes try to reach their maximum performance to compare it with that of their buddies, the test does not give any indication of the actual capabilities of the men able to exceed the maximum performance required to receive the highest points. With this fact in mind a more accurate test of abdominal strength was sought and one that filled all the needed requirements. These requirements were: (a) Does the test require a minimum of time and apparatus? (b) Is its scope so broad as to include all degrees of fitness? (c) Can it be adopted without any great change in the administrative records of the present physical fitness tests?

The exercise position used was the present sit-up form of the body in supine position with feet approximately 12 inches apart, hands laced behind head, and a partner kneeling at the feet and holding ankles firmly. Performer raises trunk, turns slightly and touches right (or left) elbow to opposite knee, alternating at each sit-up. The entire group tested was divided in half and paired off according to height and weight, one partner taking the sit-up position and the other holding the ankles and counting the repetitions. Timer and starter were situated above the group on a balcony to have control

of the entire situation. The test was started and stopped on signal from the timer and during the test any individual not executing the correct position was made to forfeit that particular repetition and count from the preceding correct one. The partners then rotated positions so all could be tested. All individuals were tested for one, two, three, and five minutes and the results recorded and correlated for a T score table. The tables were made by fitting curves to a line secured by plotting the T-scores against the raw scores.

The collected data were then analyzed by making a frequency distribution table to determine the most practical test that could be adopted. The three-minute test seems to be the most accurate in securing an estimate of the abdominal strength of the individuals. The one- and two-minute tests were not quite sufficient to tax some of the men for a maximum effort. The five-minute period tended to make the men set a pace and left them with an excessive amount of energy at the end. The three-minute period is ideal because it is not long enough to set a pace and is short enough to present a challenge to try and go "all out" for the entire time.

The results showed the performances to be:

	<i>Average</i>	<i>Best</i>
One minute	40.390	51
Two minutes	66.568	90
Three minutes.....	93.653	127
Five minutes.....	132.669	193

These scores are exceedingly high and were truly maximum effort by all concerned. One of the Navy Pre-Flight Schools had a record of 157 sit-ups in five minutes; this record was broken by 26 men of the 56th AAFTTD (Meteorology) detachment during the tests.

It is suggested that this three-minute sit-up test be given in place of a continuous sit-up performance because of its more accurate measurement of abdominal strength and the shorter time required for its completion. However, care must be taken that beginners are not started off too rapidly. It is better to work up to the three-minute test through the one- and two-minute performances rather than immediately give a rugged three-minute grind.

TABLE I*
T-SCORES FOR SIT-UPS. ONE MINUTE.

	0	1	2	3	4	5	6	7	8	9
20						2	5	8	11	14
30	17	20	23	25	28	31	34	37	40	43
40	46	48	51	54	57	60	63	66	69	71
50	74	77	80	83	86	89	92	94	97	100

*To read tables, add number on top line to number in left-hand column. For example, 28 sit-ups in Table I gives a T-score of 11.

SPEED SIT-UPS

77

TABLE II
T-SCORES FOR SIT-UPS. TWO MINUTES

	0	1	2	3	4	5	6	7	8	9
20								1	3	4
30	5	6	8	9	10	11	13	14	15	16
40	17	19	20	21	22	24	25	26	27	29
50	30	31	32	34	35	36	37	38	40	41
60	42	43	45	46	47	48	50	51	52	53
70	55	56	57	58	59	61	62	63	64	66
80	67	68	69	71	72	73	74	76	77	78
90	79	80	82	83	84	85	87	88	89	90
100	92	93	94	95	97	98	99	100		

TABLE III
T-SCORES FOR SIT-UPS. THREE MINUTES

	0	1	2	3	4	5	6	7	8	9
30						1	2	3	4	4
40	5	6	7	8	9	9	10	11	12	13
50	14	14	15	16	17	18	19	19	20	21
60	22	23	24	24	25	26	27	28	29	29
70	30	31	32	33	34	34	35	36	37	38
80	39	39	40	41	42	43	44	44	45	46
90	47	48	49	49	50	51	52	53	54	54
100	55	56	57	58	59	59	60	61	62	63
110	64	64	65	66	67	68	69	69	70	71
120	72	73	74	75	75	76	77	78	79	79
130	80	81	82	83	84	84	85	86	87	88
140	89	89	90	91	92	93	94	94	95	96
150	97	98	99	99	100					

TABLE IV
T-SCORES FOR SIT-UPS. FIVE MINUTES

	0	1	2	3	4	5	6	7	8	9
50				1	2	2	3	4	4	5
60	5	6	7	7	8	9	9	10	11	11
70	12	12	13	14	14	15	16	16	17	18
80	18	19	19	20	21	21	22	23	23	24
90	25	25	26	26	27	28	28	29	30	30
100	31	32	32	33	33	34	35	35	36	37
110	37	38	39	39	40	40	41	42	42	43
120	44	44	45	46	46	47	47	48	49	49
130	50	50	50	51	51	52	52	53	53	53
140	54	54	55	55	55	56	56	57	57	57
150	58	58	59	59	60	60	60	61	61	62
160	62	62	63	63	64	64	65	65	65	66
170	66	67	67	67	68	68	69	69	70	70
180	70	71	71	72	72	72	73	73	74	74
190	74	75	75	76	76	77	77	77	78	78
200	79	79	79	80	80	81	81	82	82	82
210	83	83	84	84	84	85	85	86	86	87
220	87	87	88	88	89	89	89	90	90	91
230	91	91	92	92	93	93	94	94	94*	95
240	95	96	96	96	97	97	98	98	99	99
250	99	100	100							

Research Abstracts

Prepared by the
NATIONAL COUNCIL OF THE RESEARCH SECTION

THE National Council of the Research Section of the American Association for Health, Physical Education, and Recreation has undertaken the responsibility for preparing abstracts of research of interest to members of our profession but not published in our journals. It was felt that *Research Quarterly* readers would appreciate brief reports of work related to their own but available in so wide a range of publications as to be frequently missed. The first group herein presented represents a beginning on this project. All of the journals from which we have permission to abstract, and no requests were refused, are not represented in these pages, nor are all the 1943 publications completed. An attempt will be made to complete the 1943 editions for the May *Quarterly*. The plan will then be to proceed on a three months' basis.

The list of publications to be covered is by no means complete. The committee would appreciate any suggestions for journals to be included as well as for individuals who can be counted on to be responsible for reporting research published in those journals.—*Aileen Carpenter*, chairman of project, Department of Physical and Health Education, University of Texas, Austin, Texas.

HEALTH AND NUTRITION

Russell, Walter Charles, Milton Wright Taylor, and Jack Frank Beuk. "The Nicotinic Acid Content of Common Fruits and Vegetables as Prepared for Human Consumption," *J. Nutrition*, v. 25, No. 3, March 10, 1943.

By means of the microbiological method nicotinic acid was determined in thirteen fresh vegetables in both the raw and the cooked state, eight fresh raw vegetables, six cooked dried legumes, three canned vegetables, seven fresh fruits, and ten canned fruit juices. The nicotinic acid content was highest for fresh peas, asparagus, and avocado pears and lowest for certain of the fruits and fruit juices. Seeds of legumes, both fresh and dried, gave fairly high values whereas the values for root crops and blanched leaves were low. Considerable variation was found among different samples of the same crop. During cooking, loss of the factor averaged as follows: fresh legumes, 8%; roots and tubers, 9%; flowery plants, 17%; leafy plants, 22%. In addition, the cooking water contained from 2 to 41% (average 12%) of the total nicotinic acid. The liquid associated with the canned vegetables contained from 30 to 40% of the total nicotinic acid.—*The Wistar Institute*.

Hemphill, Frances Inez, Ruth Adele Koenig, and Jet Corine Winters. "Nutritive Adequacy of Certain Low-Cost Food Mixtures," *J. Nutrition*, v. 25, No. 3, March 10, 1943.

In an effort to find a combination of very cheap foods that might be used as a basis for the dietary in low-income groups, four food combinations, which had been calculated for adequacy and for which menus had been pre-

pared, were assayed for certain vitamins and minerals. Their adequacy for the rat was also tested. Two higher-cost food mixtures, designed for adequacy according to the suggestions of Carpenter and Stiebeling, and a stock ration for rats were similarly assayed and fed. Results showed that two of the low-cost food mixtures were similar to the higher-priced mixtures in their vitamin and mineral contents and in the growth response produced in animals. The cheaper food mixtures cost approximately half as much as the higher-priced ones.—*The Wistar Institute*.

Mills, Clarence A., "Urban Air Pollution and Respiratory Diseases," *Am. J. Hyg.*, 37, Mar., 1943.

A survey was made of sootfall and respiratory disease rates in 19 sootfall districts of Cincinnati and 96 of Pittsburgh. Pneumonia, tuberculosis, and lung cancer were all found more prevalent among people living in the most polluted areas of industrial cities. The author believes the differences found are not due to socio-economic factors.

Fly-ash is cited as the most harmful smoke constituent. "Chemically it is a siliceous mixture somewhat similar to the rock dust which has killed hundreds of quarry and tunnel workers from silicosis. While outspoken silicosis is uncommon among city residents, it is possible that a lower grade of irritation in sinuses, air passages, and lungs may be responsible for much of the increased respiratory disease hazard in polluted urban atmospheres." Suggested control measures are discussed.—*Roland Rooks*.

Clayton, Mary Morris, and Ruby Anne Borden, "The Availability for Human Nutrition of the Vitamin C in Raw Cabbage and Home-Canned Tomato Juice," *J. Nutrition*, v. 25, no. 4, April 10, 1943.

The availability of the vitamin C in raw cabbage and home-canned tomato juice was studied on four young, healthy subjects. The utilization of the vitamin C of each test food was compared with that of pure vitamin C tablets. The basal diet used was neutral in reaction and the subjects were saturated before each test period. Judging from the results of both blood and urine analyses, the vitamin C of both raw cabbage and tomato juice was utilized as well as, or possibly better than, that in the tablets. An average of 116 gm. of cabbage or 208 ml. ($\frac{7}{8}$ cup) of the tomato juice used in this experiment provided 50 mg. of vitamin C.—*The Wistar Institute*.

Bunkfeldt, Rudolph, and Harry Steenbock, "The Effect of Dietary Fat on Bone Calcification in the Growing Rat," *J. Nutrition*, v. 25, no. 5, May 10, 1943.

When cottonseed oil was included in a low-phosphorus, cereal-free rachitogenic ration for rats, calcification was decreased uniformly and in proportion to the amount of oil fed. This occurred when the phosphorus of the ration was derived from phytic acid or from inorganic phosphates. It occurred on a diet with a high calcium-phosphorus ratio (6:1 and 3:1), and one with a low calcium-phosphorus ratio (1:1), and in the presence or absence of vitamin D. When fibrin, yeast, and starch were substituted for egg white, rice bran concentrate, and glucose respectively, the results were the same. The depressing action of cottonseed oil was in direct proportion to the amount of oil fed and paralleled the greater increments in weight produced by the fat rations as compared with the basal. However, the greater increments in weight were not due to an increase in either lipid-free soft tissues or lipid-free bone. When cottonseed oil was included in a diet optimal in phosphorus content, calcification was increased to a pronounced degree; when it was included in a diet containing more "optimal" amount of phosphorus it was likewise increased, though to a lesser degree. These effects

were not negated by increase in the calcium-phosphorus ratios by a multiple of four.—*The Wistar Institute.*

Brown, Almeda P., Margaret L. Fincke, Jessie E. Richardson, Elizabeth Neige Todhunter, and Ella Woods, "Ascorbic Acid Nutrition of some College Students," *J. Nutrition*, v. 25, no. 5, May 10, 1943.

In a cooperative study in Washington, Utah, Oregon, Montana, and Idaho, 471 healthy college women and 342 college men students were tested for levels of ascorbic acid in the blood plasma on two non-consecutive mornings. Plasma levels were classified into four groups: 1.0 or more milligrams ascorbic acid per 100 ml., 0.8 to 0.99 mg., 0.4 to 0.79 mg., and less than 0.4 mg. per 100 ml. The mean ascorbic acid plasma level for all women was 0.797 mg. and that for all men, 0.592 mg. per 100 ml. Women subjects at Montana and Washington showed a higher mean plasma ascorbic acid value than those at Oregon and Utah, while men subjects at Washington had a higher mean level than those at Oregon or Idaho, and Utah men had a mean value close to the mean for all men. Women boarding in cooperative houses had a higher mean plasma level than other groups, while of the men, those eating at home or in boarding houses had the highest mean plasma ascorbic acid values. In the different academic classes, sophomore and senior women had higher values than freshmen or junior women; and senior men had higher mean value than men from the other three classes. No correlation was found between plasma ascorbic acid levels and height, weight, or age.—*The Wistar Institute.*

Rohrer, Alice B., and Henry Chapp Sherman, "The Bodily Store of Vitamin A as Influenced by Age and by Food," *J. Nutrition*, v. 25, no. 6, June 10, 1943.

Offspring of rat families whose diets, otherwise similar, contained respectively 3, 6, and 12 international units of Vitamin A per gram of air-dry food, were killed at ages of 30 and 60 days and the vitamin A values of their livers and muscle tissues determined. Whether compared at the age of 30 or 60 days the vitamin A in the liver was found to have been decidedly influenced by the level of nutritional intake of this vitamin. The skeletal muscles of the same animals showed differences in the same direction, but so small as to be of doubtful statistical significance. Storage of vitamin A in the body, as reflected by the concentration in the liver, was found to have continued in the second age period studied when the level of nutritional intake of the vitamin was high but not when it was near the minimal-adequate level.—*The Wistar Institute.*

Orten, Aline Underhill, and James M. Orten, "The Role of Dietary Protein in Hemoglobin Formation," *J. Nutrition*, v. 26, no. 1, July 10, 1943.

The relation of dietary protein to hemoglobin formation has been studied in the rat by following the hematological effects of a prolonged restriction of dietary protein (lactalbumin). Normal, calorie control, and inanition control groups of rats were studied simultaneously.

The feeding of a diet low in protein but adequate in all other respects to young rats for a period of 76 days produced a mild chronic anemia characterized by a sub-normal concentration of hemoglobin in the blood, a normal erythrocyte count, and an elevated reticulocyte count.

The low-protein anemia could be prevented or alleviated by increasing the protein intake without altering the amount of calories, minerals, or vitamins ingested. Increasing the allowance of either calories or iron, on the other hand, did not increase the hemoglobin content of the blood of the low-protein animals.

These observations warrant the conclusion that an adequate intake of dietary protein (in this case, lactalbumin) is essential for the maintenance of a normal amount of hemoglobin in the blood of the rat.—*The Wistar Institute*.

Campbell, Harriet Louise, Constance Sarah Pearson, and Henry Clapp Sherman, "Effect of Increasing Calcium Content of Diet upon Rate of Growth and Length of Life of Unmated Females," *J. Nutrition*, v. 26, no. 3, September, 1943.

A limited addition of calcium to a diet of about minimal adequate calcium content results in equally increased length of life in corresponding male and female rats if the latter do not invest the extra calcium in increased reproduction and lactation instead.—*The Wistar Institute*.

Eames, Thomas Harrison, "The Effect of Correction of Refraction Errors on Distant and Near Vision of School Children," *Jl. of Ed. Res.* v. 33, no. 1, September, 1943.

The investigation involved complete ophthalmological examination of 100 unselected school children requiring correction of refractive errors. The Snellen Test was used before and after corrections were made. Eighty-one per cent showed improvement in visual acuity after correction.

The author points out that glasses do not always produce normal vision. Teachers need to know the new visual status of pupils wearing glasses and encourage them to wear glasses as directed.

The Snellen chart was found to be efficient in detecting myopia but somewhat inefficient in detecting hypermetropia.

The frequencies, median improvements, and coefficients of correlation for the corrected and uncorrected vision were noted and the findings presented.—*Helen Coleman*.

Heller, Christene A., Clive Maine McCay, and Channing B. Lyon, "Adequacy of the Industrial Lunch and the Use of Brewer's Yeast as a Supplement," *J. Nutrition*, v. 26, no. 4, October, 1943.

The meals served workers in one cafeteria in the Brooklyn Navy Yard have been sampled for the determination of riboflavin, niacin, and thiamine. This noon meal usually furnishes at most only one-fourth of the day's requirements for these vitamins. Dry brewer's yeast has provided a satisfactory method of supplementing the supply of these vitamins. This yeast was usually incorporated in the meat dishes at conservative levels, so that the taste was not detected. Since yeast is rich in protein of good quality it also affords a good source of this constituent.—*The Wistar Institute*.

Dalton, M. M., "A Visual Survey of 5,000 School Children," *Jr. of Edu. Res.* v. 37, no. 2, October, 1943.

A survey made of 5,000 school children in elementary and high school was made in an effort to determine the relationship of normal and defective vision and scholastic achievement, the percentage of defective vision, and the types of defects most common. The Keystones Telebinocular was used following closely the procedures outlined by Betts. The personnel of the examiners was carefully selected and trained to detect departures from the normal.

Results of tests including borderline cases revealed 40 per cent of all the students had a lack of some type of coordination which contributed to poor vision. The ratio of zero acuity of the left eye to the right eye was two to one. The higher percentage of defects in high school students was thought to be caused by eye strain due to the extensive reading requirements through-

out the elementary grades and the differences in the type of the printed page.

Comparisons of academic achievements of those of normal vision and those of defective vision show no indication of significant difference of intelligence or academic aptitude on the basis of manual or mental tendencies. Little if any general relationship was found between normal and defective vision and scholastic achievement.—*Helen Coleman.*

Cheldelin, Vernon H., and Robert R. Williams, "Studies of the Average American Diet. II. Riboflavin, Nicotinic Acid and Pantothenic Acid Content," *J. Nutrition*, v. 26, no. 4, October, 1943.

The rapid accumulation of knowledge regarding the B vitamin contents of foods has made it possible to evaluate more properly than was previously possible the actual amounts of these foods entering into the average American diet. These studies are especially timely in view of their importance to national nutrition. In the present study, such an appraisal has been made for riboflavin, nicotinic acid, and pantothenic acid. Assays have been made on the more important foodstuffs in the American diet in proportions corresponding to the annual per capita consumption of each during the period 1934-1937. It has been found that the riboflavin, nicotinic acid, and pantothenic acid contents of the average American diet are approximately 1.4 mg., 11 mg., and 4.9 mg., respectively, per 2,500 calories. Enrichment of bread and flour to meet prevailing standards increases the level of riboflavin, 12% to 1.6 mg., that of nicotinic acid, 53% to 17 mg. Tables are presented to permit the calculation of thiamine contents of other diets.—*The Wistar Institute.*

Holmes, Arthur Dunham, Carleton P. Jones, Anne W. Wertz, and John W. Kuzmeski, "The Ratio of Ascorbic Acid, Riboflavin and Thiamine in Raw and Pasteurized Milk," *J. Nutrition*, v. 26, no. 4, October, 1943.

The ratio of ascorbic acid, riboflavin, and thiamine has been determined for winter milk produced under controlled conditions by the college herd of Ayrshire, Guernsey, Holstein, Jersey, and Shorthorn cows. Vitamin contents were determined for samples taken just previous to and immediately following pasteurization by the holding process for 30 minutes at 143°-145° F. The ascorbic acid content of the raw milk ranged from 14.0 to 22.5 mg. (average 19.7 ± 18 mg.) per liter; after pasteurization in stainless steel equipment, corresponding values were 7.0, 19.1 and 15.9 ± 2.7 mg., respectively. The riboflavin content of the raw milk varied from 1.35 mg. to 1.75 mg. (average $1.51 \pm .09$ mg.) per liter. Corresponding values for pasteurized milk were 1.19, 2.06, and $1.48 \pm .01$ mg. per liter, respectively. The thiamine content of the raw milk varied from 0.29 to 0.35 mg. (average $0.33 \pm .02$ mg.) per liter. Corresponding values for the pasteurized milk were 0.21, 0.34, and $0.30 \pm .03$ mg., respectively. The raw milk contained $4.6 \pm .3$ times as much riboflavin as thiamine, 13.1 ± 1.43 times as much ascorbic acid as riboflavin and 59.8 ± 6.40 times as much ascorbic acid as thiamine. On the average the pasteurized milk contained $4.9 \pm .81$ times as much riboflavin as thiamine, 11.0 ± 1.93 times as much ascorbic acid as riboflavin, and 53.8 ± 9.63 times as much ascorbic acid as thiamine.—*The Wistar Institute.*

Heller, Christene A., Clive Maine McCay, and Channing B. Lyon, "Losses of Vitamins in Large-Scale Cookery," *J. Nutrition*, v. 26, no. 4, October, 1943.

Preliminary studies were made in a large industrial cafeteria to determine the losses in vitamins in vegetables under actual operating conditions. The losses, in per cent, ranged as follows: thiamine 16-64; niacin 2-61; riboflavin 22-45; ascorbic acid 27-90. Changes were then made in the vegetable cookery

by decreasing radically the time of cooking large quantities. The time of holding vegetables between cooking and service was also cut to a minimum. Texture, flavor, and appearance were improved.

A comparison of the thiochrome and fungus assay methods for the determination of thiamine gave excellent results for analyses in vegetables.—*The Wistar Institute.*

Barnes, M. E., I. H. Borts, C. I. Miller, and M. Peare Spanswick, "Serologic Reactions in Nonsyphilitic Individuals," *Journal of Iowa State Medical Society*, November, 1943.

Serologic tests have come to be regarded as having a validity which is "all but overwhelming." The authors point out, however, that serologic reactions in human sera provide *presumptive* evidence of the existence of syphilis, not conclusive evidence. Tables showing contradictory reactions among reactors to the Kline, Kahn, and Kahmer tests are given. Studies are reported wherein when positive reactors to some of the three tests were put on low protein diets for several weeks, they reverted to complete negative. Further studies and comparisons are reported leading to the conclusion that reliance should not be placed solely on serologic reports, that when reactions can be caused to disappear when dietary factors are changed, the causative factor in the reaction is not active syphilis.—*Aileen Carpenter.*

Cheldelin, Vernon Hendrum, Alethea Marie Woods, and Roger John Williams, "Losses of B Vitamins Due to Cooking of Foods," *J. Nutrition*, v. 26, no. 5, November, 1943.

Samples of thirty foods, including cereals, flesh foods, dairy products, vegetables, fruits, and a few miscellaneous items were assayed for six B vitamins before and after cooking. Losses due to cooking were determined. Microbiological assays were employed.

Riboflavin was destroyed in variable amounts in the presence of light; losses in the dark were negligible. Nicotinic acid losses were generally slight. Pantothenic acid losses were moderate to slight in vegetables, but somewhat larger, up to one-third, in meats. Biotin losses were moderate in vegetables but larger in meats. Inositol losses were generally small in meats but great in a few vegetables such as legumes. Folic acid losses were very high in most foods.—*The Wistar Institute.*

Burke, Bertha Shapley, Virginia Asta Beal, Samuel Brown Kirkwood, and Harold Coe Stuart, "The Influence of Nutrition During Pregnancy Upon the Condition of the Infant at Birth," *J. Nutrition*, v. 26, no. 6, December, 1943.

This study deals with the influence of the diets of 216 women during pregnancy, upon the fetal growth and development of their infants. The women were followed at the Boston Lying-in Hospital for the major portion of pregnancy. Pediatric ratings were based upon examinations at birth and at 2 weeks. Nutrition data were based upon detailed prenatal dietary histories. Forty per cent of the women were definitely malnourished by accepted standards and 23% had only mediocre diets. There were 200 full-term, 9 premature, 5 stillborn, and 2 infants who died shortly after birth. A statistically significant relationship was found to exist between the diet of the mother during pregnancy and the condition of her infant. If the prenatal diet is poor to very poor, the mother will undoubtedly have an infant whose physical condition is poor. In the 216 cases, all infants who were stillborn, and who died shortly after birth, except one, were premature or "functionally immature"; and most infants who had marked congenital defects were born to

mothers whose diets during pregnancy were very inadequate. If the prenatal diet is good or excellent, the infant will in all probability be in good or excellent physical condition. Rarely, a mother whose diet during pregnancy was good or excellent will give birth to an infant in poor physical condition (one out of 216 times in this study).—*The Wistar Institute*.

Boutwell, Roswell, Roswell Knight, Robert Pershing Geyer, Conrad Armond Elvehjem, and Edwin Bret Hart, "Further Studies on the Comparative Nutritive Value of Butter Fat, Vegetable Oils, and Oleomargarines," *J. Nutrition*, v. 26, no. 6, December, 1943.

On a comparative growth-promoting basis, butter fat and lard were superior in the early nutrition of the rat to corn oil, when a ration containing 48% of lactose and 28% of fat was employed. When the lactose was replaced by a mixture of carbohydrates consisting of sucrose, dextrose, dextrin, starch, and lactose, all of the oils and fats tested had equal nutritive value. Growth of rats on the mixed carbohydrate regime was greater than that of the corresponding animals on the lactose diet.

Properly fortified oleomargarines were studied on both the lactose and mixed carbohydrate diets. When lactose was the sole carbohydrate, rats fed butter fat grew slightly better than animals fed oleomargarines of vegetable origin. Efficiency in food utilization was highest for the rats fed butter fat or the animal oleomargarines. On the mixed carbohydrate regime, butter fat and the oleomargarines had equal growth-promoting value, and the rats grew at a rate superior to the corresponding animals on the lactose diet.—*The Wistar Institute*.

Neher, Gerwin, "What High School Students Know, Think, and Do about Health," *The Physical Educator*, v. 3, no. 2.

Pupils numbering 2,415 from thirteen junior and senior high schools of Los Angeles were given the High School Health Inventory (composed of 69 multiple choice items and an attitude scale designed to determine the nature of attitudes held toward certain health practices). From this there was determined the amount and nature of the health knowledge, attitude, status, and practice of high school pupils. An analysis was made of the differences in these variables when students were grouped according to school, grade, age, sex, course of study followed, occupation of father, and race.

The findings were:

1. In general, pupils on an average or higher intelligence level and relatively high socio-economic level scored above the others on all four factors.
2. Statistically significant differences were found (in favor of the girls) between boys and girls in health knowledge and attitude.
3. Industrial arts students ranked highest in health status.
4. Pupils, whose fathers were in professional and managerial occupations, ranked consistently higher in all four health factors than did those pupils whose fathers were in other occupations.
5. In general, white pupils scored higher than other racial groups on the four factors.
6. Only a slight positive correlation was found between health knowledge and attitude and the stated health status and practice of the pupils.—*C. Bookwalter*.

BIOLOGY AND PHYSIOLOGY

Girden, Edward, "Continuous Recording of Pulse and Blood Pressure," *Jl. of Exp. Psy.*, v. 32, no. 1, January, 1943.

The Parker polygraph has been found to be adequate when used either in

the horizontal or vertical position. It has three speeds, 7.5 cm., 30 cm., and 45 cm. per minute and takes a 300 ft. roll of paper 6 in. wide. The use of wax paper and hot point needles constructed of thin microme wire tends to avoid inertia with a minimum of distortion. The apparatus, after once set, functions for the duration of the experiment. In actual practice with only three signal magnets, it is possible to record easily blood pressures up to 150 mm. Records were taken without interruption for six hours.

The speed of 7.5 cm. per min., was too slow to record pulse beat. The medium speed of 30 cm. per second records pulse adequately.

This technique also records advantageously pupillary responses in human beings by means of a pupillometer.—*Helen Coleman.*

Counts, E. W., "Growth Patterns of the Human Physique: An Approach to Kinetic Anthropometry," *Human Biology*, 15, February, 1943.

Using the data of various investigators, growth curves are obtained by plotting somatic measures against time. These curves are then analyzed and reduced to mathematical formulas, which turn out to be of the exponential type.

Growth accelerations were found to occur at about the ages of first and second permanent molar completion, and growth practically ceases at the third-molar period. These accelerations speed up the process of growth but they do not alter the growth patterns of bodily proportions. The second, or adolescent acceleration, does not affect adult size any sooner than the pre-pubertal growth pattern would have done; it only hastens it at first, then later so retards it that growth finally ceases.

Although the mathematical procedures explained in this article may not be clearly understood by those who have not had a good background in mathematics, the ideas involved and the results obtained should be of general interest.—*Elizabeth Powell Salit.*

Kelly, H. J., et. al., "Daily Decreases in the Body Total and Stem Lengths of Normal Children," *Human Biology*, 15, February, 1943.

Morning and evening recumbent lengths were obtained for 6 boys and 4 girls at approximately two-week intervals for eight consecutive months. The average decreases in total length per child during the day ranged from 13 to 18 mm. and represented from 1.1 to 1.6 per cent of the corresponding total lengths of the children. These differences are approximately equivalent to three months' gain in recumbent length by the same children. The morning measurements are more reliable than those taken in the evening because of less variability due to tissue changes and the amount of physical activity.—*Elizabeth Powell Salit.*

Farris, Edmond J., "The Blood Picture of Athletes as Affected by Intercollegiate Sports," *Am. J. Anat.*, v. 72, no. 2, March, 1943.

Over 300 blood counts were made on college athletes before and after match games. In most of the eight sports an emotional lymphocytosis was evidenced before the game, with concomitant reduction in the neutrophiles.

In football, basketball, and baseball the relative lymphocytosis disappeared during the course of the game. In wrestling and track the lymphocytosis is increased during the course of the event. In tennis, golf, and crew the relative lymphocytosis remained about the same throughout the event. Some indication of the physical condition of each player was furnished by the differential blood-count picture after football, basketball, and baseball games. Blood counts of players fatigued to exhaustion ranged from 80-91% neutrophiles.

Intensity of activity in competition, together with duration, produced a

leucocytosis in all events. A certain intensity in activity was essential to produce the marked leucocytosis, in spite of duration.

The total number of erythrocytes per cubic millimeter was increased in the short-term athletic events, and usually decreased in events which lasted over 25 minutes.—*The Wistar Institute.*

McCrery, Jonnie, Mino Wolf Lamb, and Neva Deen Bavousett, "The Basal Metabolism of Normal College Women," *J. Nutrition*, v. 25, no. 3, March 10, 1943.

The basal metabolism of 124 women ranging in age from 18 to 38 years was determined with a Benedict-Roth apparatus. The average basal metabolism of the group was found to be 1304 Cal. per 24 hours, 33.4 Cal. per square meter per hour, or 0.95 Cal. per kilogram per hour. The average deviations of the basal metabolism from the standards are —7.6% from Harris-Benedict, —8.0% from Dreyer, —10.5% from Aub-Dubois, and —8.4% from Mayo. No significant difference was found between the age groups with the possible exception of that between the 21- and 22-year-old groups. Between these ages the chance is greater that there is a statistically significant difference, even though it is a small one. The results obtained on these subjects do not differ significantly from those of comparable groups studied at various places. The authors believe that any differences which do occur are the result of slight but significant variations of technique.—*The Wistar Institute.*

Wenger, M. A., "An Attempt to Appraise Individual Differences in Level of Muscular Tension," *Jl. of Exper. Psych.*, v. 32, no. 3, March, 1943.

The following two problems as quoted by the author were considered: "(a) can the postulated trait of characteristic level of muscular tension be rated reliably; and (b) if so, will the ratings serve to define a muscular factor when included in a body of appropriate data submitted to factor analysis?" Characteristic levels of muscular tension were rated by a scale developed after the Champney form. These ratings and 16 other physiological variables were intercorrelated and submitted to factor analysis by the centroid method. One meaningful factor found was defined as the factor of muscular tension. Wenger states, "Both sets of correlations are believed to furnish additional evidence that generalized muscular tension is a correlate of certain aspects of personality." He concludes, "That factorial estimation affords the most adequate technique for the measurement of general muscular tension and further analysis of more rigorously designed tests should yield a muscular factor of considerable significance in the appraisal of human behavior."—*Helen Coleman.*

Wolff, Georg, and Morris Steggerda, "Female-Male Index of Body Build in Negroes and Whites: An Interpretation of Anatomical Sex Differences," *Human Biology*, 15, May, 1943.

The sexes differ mostly in weight as indicated by the low value (.797) of the F/M index. The Tuskegee women weigh only about 80 per cent as much as the men, but in stature they are only 7 per cent smaller. Relatively low F/M indices for chest measures indicate that the females are less stocky than the males. When the intercrystal breadth is divided by shoulder breadth, the females develop significantly higher percentages than the males. Negroes have significantly longer arms and legs than whites.—*Elizabeth Powell Salit.*

Hellebrandt, F. A., and E. B. Franseen, "Physiological Study of the Vertical Stance in Man," *Physiological Reviews*, 23, July, 1943.

As physical educators we tend to think of posture chiefly in terms of segmental alignment and the achievement of positions which are acceptable from

an esthetic point of view. We know too little about other phases of the subject; therefore this comprehensive report on the physiological aspects of vertical stance should be of considerable interest.

Some idea of the content can be gained from the sub-headings: the penalties of poor posture, the biodynamics of standing, the neurological basis of standing, the energy cost of standing, compensations for the hydrostatic effect of gravity, and orthostatic circulatory insufficiency. In general we subscribe to the idea that poor posture may adversely affect the functioning of the vital organs and give rise to exhaustive muscular activity, but neither of these views is supported by convincing experimental evidence.

"Standing is cheap in terms of metabolic cost and it has yet to be demonstrated unequivocally that improvement in so-called body mechanics is associated with a significant decrease in energy exchange."—*Elizabeth Powell Salit.*

House, Ralph W., "The State of Maturation Found in 318 First-Grade Pupils," *Jl. of Ed. Res.*, v. 37, no. 3, November, 1943.

This article reports an experiment to determine the status of body maturation of 318 pupils selected from the entire enrollment of first grades of elementary training schools of three state teachers colleges and one state university, one church elementary school, and six public elementary schools.

Todd's Differential Skeletal Maturation Method was used in assessing the radiographs of the posterior anterior X-rays of the left hand and wrist.

Twenty-one per cent of the group revealed a body maturation of ten months or more under the chronological age. Sixty-six per cent had approximately the same body maturation as chronological age, and thirteen per cent were ten months or more above the chronological age.—*Helen Coleman.*

Jenss, Rachel, "Gain in Weight and the Child's Physical Fitness," *Human Biology*, 15, Dec., 1943.

Both the absolute gain in weight and the percentage gain may be used as an index of the physical fitness of 6-year-old children. As children of this age form a more homogeneous group with respect to growth and development than either older or younger children, the value of gain in weight as an index of fitness is greatest for this age group. Gain in weight does not necessarily reflect a child's condition, but any gross variation can be followed up and its cause ascertained.—*Elizabeth Powell Salit.*

Pappenheimer, A. M., "Muscular Disorders Associated with Deficiency of Vitamin E," *Physiological Reviews*, 23, July, 1943.

In various experimental animals, and probably also in man, vitamin E deficiency gives rise to weakness and degenerative changes in striated muscle and to increased oxygen consumption. Some protection against fiber degeneration is offered by cutting either the motor nerve or the muscle tendon. It is believed that vitamin E is concerned with the contractile rather than the resting metabolism of the muscle. Although there is some evidence to the contrary, this is essential to the integrity of the nervous system.—*Elizabeth Powell Salit.*

Oppenheim, A., "Blood Tests As An Education Aid." *Jr. Social Hygiene*, v. 29, no. 2.

A survey of syphilis in high school age groups, both negro and white, boys and girls, was made in Bienville Parish at Arcadia, La. The group of students was composed of volunteers for the blood tests. About 70% (140) of the white students volunteered and about 90% (245) of the negro students volunteered. Few of the students seemed to know what syphilis was or how it was acquired.

No positive results were found in the white group. Of the negro group 4.9% had positive S.T.S.

A similar survey of selective service men of the parish showed a rate of 1.2% for the white males and 18.2% for the negro. This marked increase above that of the high school group indicates the importance of reaching these potential syphilitic patients.—*Carolyn Bookwalter*.

PHYSICAL EDUCATION

Rethlingshafer, Dorothy, "Measurement of a Motor Set," *Jl. of Exp. Psy.*, v. 32, no. 1, January, 1943.

Rethlingshafer states that "any motor set, apparently set up by a forced rhythm, is quite temporary, although it lasts long enough to affect a highly reliable performance." The natural rhythm of the motor set was determined by three trials of tapping on the Stoeling tapping board. A metronome was used to set the enforced rhythm rate. The natural tapping rate can be reproduced at varied sessions with a high reliability. Three specific conditions were investigated. Namely the effect when subjects tapped at half their natural rate, effect when forced to go faster than natural rate, and a constant rhythm for the entire group.

The effect of the enforced rhythm shows marked individual differences.—*Helen Coleman*.

Seltzer, Carl Coleman, and Lucien Brouha. "The 'Masculine' Component and Physical Fitness," *Am. J. Phys. Anthropol., N. S.*, v. 1, no. 1, March, 1943.

This paper deals with the influence of the "masculine" component on the physical fitness of young college men before and after a period of training. The gradations of the "masculine" component are fourfold: strong, medium, weak, and very weak. The degree of physical fitness of the individual is derived from the physical fitness index of the "Step Test." As a result of the analysis of data obtained on 1,173 college students before training and 723 individuals after training, it appears that the degree of "masculine" component is closely related to the physical fitness for hard muscular work both before and after training. The higher the physical fitness the less frequent the weaker masculine body types. Any weakness in the "masculine" component seems to go along with lower physical fitness. A superior degree of physical fitness can be achieved only by the subjects who have a strong "masculine" component.—*Wistar Institute*.

Bookwalter, Karl W., and Carolyn W. Bookwalter, "A Measure of Motor Fitness for College," *Bulletin of the School of Education, Indiana University*, v. 19, no. 2, March, 1943. (Bureau of Cooperative Research and Field Service, Indiana University, Bloomington, 26 pages, 50c.)

Based upon a survey of factor analysis studies a 20-item criterion was established. With over 900 cases I. U. Motor Fitness Index was found to have a validity coefficient of .831 + .01 with the criterion. The test consists of (chins + push-ups) \times vertical jump, all items modified-T-scored. Thirteen other combinations utilizing Larson weightings, modified T-scores, and raw scores did not meet all criteria as well.—*Carolyn Bookwalter*.

Cureton, T. K., "The Unfitness of Young Men in Motor Fitness," *Jr. of A. M. A.*, v. 123, September 11, 1943.

As the author points out, a large proportion of the young men entering college from high schools are unable to handle their bodies with the degree of efficiency needed in wartime. He goes ahead to list the qualities included in physical fitness, what lack of each means, how each can be developed. He

reports results on a sample of 1,000 men entering college in 1940, describes the Motor Fitness Screen Test, and gives suggested standards for ratings. He further presents an analysis of the motor fitness of 2,628 men entering the University of Illinois in 1942. The implications of motor unfitness with which the author concludes each deserve careful consideration.—*Aileen Carpenter.*

Bookwalter, Karl W., "Further Studies of Indiana University Motor Fitness Index," *Bulletin of the School of Education*, Indiana University, v. 19, no. 5, Sept., 1943. (Bureau of Cooperative Research and Field Service, Indiana University, Bloomington, 48 pages, 50c.)

Straddle chins (mass administered), substituted for the regular chinning, produced an r , of $.841 \pm .01$ as compared with $.859 \pm .01$ for the original I. U. Motor Fitness Index, both validated against an improved 12-item criterion. Two other combinations employing standing broad jump have acceptable r 's of $.818 \pm .01$ and $.812 \pm .01$.

An administrative-ability grouping using any of these indices with McCloy's Classification Index is validated.

Achievement scales in all four indices are established for nine height-weight classes and for seven Classification Index groups for College Men. A test manual is contained in the study.—*Carolyn Bookwalter.*

Rarick, Lawrence, "A Survey of Athletic Participation and Scholastic Achievement," *Jl. of Ed. Res.*, v. 37, no. 3, November, 1943.

A survey was made of the literature dealing with the relationship of scholastic achievement to interscholastic, intercollegiate, and intramural athletic participation. The studies reviewed included seven surveys of interscholastic athletics, the Carnegie Foundation Report on College Athletics which included ten studies, and four studies of intramural participation.

The general trend seemed to indicate no deleterious influence on scholastic achievements from participation in athletics. Those participating extensively in intramural programs compared most favorably in scholastic achievement.

The author concludes, "Since it is difficult to demonstrate that time spent in athletic participation is detrimental to scholarship, and since it is becoming increasingly evident that good health and physical fitness is a worthy goal, more time could be spent on conditioning activities in both high schools and colleges."—*Helen Coleman.*

Begnoche, Marguerite, "A Comparison of Junior High and Senior High School in National Achievement Scales Used to Score Athletic Performances of Freshmen Girls," *The Physical Educator*, v. 4, no. 1.

The purpose of the study is to determine whether there is a need for classifying freshmen girls according to age-height-weight.

A group of 314 girls was tested in five activities in October and re-tested in May. The activities were: potato race, 50-yard dash, jump reach, accuracy throw, and distance throw. These were scored by the achievement scales for junior and senior high school levels (Neilson and Cozens; Cozens, Cubberly, and Neilson).

The girls were classified by height-weight-age (Neilson and Cozens) in October and again in May. The classified groups were then compared by using the junior high and senior high scales.

Results showed there was no need to classify by height-weight-age at the end of the freshmen year as no group was penalized when scored according to the single scale (senior high). Either scale can be used to score performances of freshmen girls. However, the senior high scale is preferable as it requires no height-weight-age classification.—*Carolyn Bookwalter.*

Crogen, Corinne, "A Simple Volleyball Classification Test for High School Girls," *The Physical Educator*, v. 4, no. 1.

A single-item test is proposed for classifying high school girls for volleyball. A minimum amount of time and equipment are involved. The equipment necessary includes a volleyball, free wall space marked according to directions, and a floor space on which is marked a restraining line.

The player being tested stands behind the restraining line and throws the ball to the wall in any manner, attempting to make the ball hit above the net line on the wall. As the ball rebounds from the wall it is volleyed repeatedly with the option of setting it up once to self each time. After the ball is thrown the testee may move anywhere. When a foul is called, the testee stops and continues again from the restraining line. Testee continues until ten hits are recorded. The score of the test is the number of fouls subtracted from 10. A ball is counted *either* a hit *or* a foul.

The validity of the test is based upon ability to score in volleyball in competition. Statistically significant differences were found between percentages and these became progressively greater as groupings were made pure and analogous. Reliability was found to range from .63—.70. One hundred seventy-four cases were involved in the study.—*C. Bookwalter*.

SAFETY

Mercer, Guy, "Student Accidents," *Safety Education*, v. 22, no. 6, February, 1943.

Statistics pertaining to student accidents in school buildings, traffic, and on playgrounds.—*Leslie W. Irwin*.

Doscher, Nathan, "Break Down the Barriers," *Safety Education*, v. 22, no. 7, March, 1943.

A study of causes of home accidents. The information pertaining to home accidents was secured by students enrolled in a college safety class through the use of a questionnaire distributed to homes. The questionnaires were answered in the presence of the students.

The causes of home accidents as revealed by the questionnaires are presented in their order of importance.—*Leslie W. Irwin*.

Mercer, Guy, "Communique," *Safety Education*, v. 22, no. 8, April, 1943.

Statistics pertaining to causes of deaths among children of school age. Also, changes in fatality rates are shown.—*Leslie W. Irwin*.

Mercer, Guy, "Student Accidents," *Safety Education*, v. 22, no. 8, April, 1943.

Statistics of a comparative nature of student accidents. The number of accidents of different types for children from kindergarten age through high school are presented in terms of "student-days."—*Leslie W. Irwin*.

Englander, William, "Student Accidents," *Safety Education*, v. 23, no. 1, Sept., 1943.

Current statistics concerning school accidents. Shows the incidence of accidents by school grades which happen in various places throughout the school plant.—*Leslie W. Irwin*.

EDUCATION

Ryans, D. G., "Research in Learning," *Journal of Educ. Res.*, v. 36, no. 5, January, 1943.

A critical discussion of research in learning. In this discussion the author's views are presented with a three-fold purpose in mind. First to review trends in recent research concerned with the problem of learning. Second, to survey briefly the research techniques employed in learning experiments,

and third, to reiterate a plea for careful planning and conduct of research on the part of investigators and for critical appraisal of research findings on the part of educational practitioners.—*Leslie W. Irwin.*

Curtis, Frances D., "A Study of the Relative Values of Two Modifications of the True-False Tests," *Jl. of Educ. Res.*, v. 36, no. 7, March, 1943.

Modification of the true-false tests requiring corrections as well as identification of the false statements tend to eliminate guessing. The second modification requires corrections of false statements by changing or substituting any word in the statement. The third modification has been made in an effort to eliminate difficulties in scoring, slowness in administration, and the somewhat subjectiveness of the second form. The third form requires corrections to be made by changing only the underlined word appearing in the test question.

Curtis states that insofar as the results investigated may be indicative, neither of the modified forms of the true-false tests possesses marked advantage over the other. Both forms stimulate thinking and tend to eliminate guessing.—*Helen Coleman.*

Ter Keurst, A. J., and R. E. Bugbee, "A Test on the Scientific Method," *Journal of Educ. Res.*, v. 36, no. 7, March, 1943.

The authors explain their methods and procedures in developing a test on the scientific method.

It is the purpose of the test to provide one means by which teachers or students can check themselves on an understanding of the methodology of science.

The basic items for the test were obtained from the faulty use of the scientific method as revealed by the errors of students in classes in psychology and biology. The test, which is included, is made up of 50 items.—*Leslie W. Irwin.*

Bateman, Richard M., "The Construction and Evaluation of a Scale to Measure Attitude Toward Any Educational Program," *Journal of Educ. Res.*, v. 36, no. 7, March, 1943.

Report of the development of a scale to measure attitude toward various types of educational programs found in most schools. The scale is designed to measure students' attitudes toward such phases of the school program as homerooms, assembly programs, group guidance, individual guidance, and in fact any phase of the school program of a socio-psychological nature. Forms A and B of the scale are presented along with the scale and Q value of the items.—*Leslie W. Irwin.*

Symonds, Percival M., "The Needs of Teachers as Shown in Autobiographies," *Jr. of Educ. Res.*, v. 36, no. 9, May, 1943.

The autobiographies of 50 teachers in a mental hygiene class are used in an attempt to ascertain the adjustment needs of teachers. Close study of these autobiographies gives clues to the possible factors causing individuals to select teaching as a profession and the ways in which teaching may satisfy those needs. Close examination of differences between teachers and undergraduate studies shows teachers have greater need for cognizance, nurturance and deference, and lesser need for abasement and play. Achievement, affiliation, infavoidance rank high in the needs.

It must be recognized that autobiographies are limited in reliability inasmuch as the individual wishes to present himself in the best possible light.—*Helen Coleman.*

Seagoe, Mary V., "Standardized Tests in the Pre-training Selection of Teachers," *Jl. of Educ. Res.*, v. 36, no. 9, May, 1943.

Seagoe states, "It is assumed that selection for teacher training is important and that standardized tests constitute one valid approach to the problem." The study is concerned with predicting teacher success at the elementary school level. The author presents comparisons of a total freshman group and a teacher-training group studied over a two and one-half year period with the use of standardized tests in the areas of intelligence, special abilities, personality, attitudes, interests, and teaching prognosis. The University of California Rating Scale for Practice Teachers is used as a criterion to select areas which best differentiate students who do well from those who do poorly in the work of practice teaching. Selective factors are found in the areas of intelligence, special abilities, and interests in the teacher-training group.—*Helen Coleman*.

Weber, C. A., "A Summary of the Findings of the Sub-Committee on In-Service Education of the North Central Association of Colleges and High Schools," *Jr. of Educ. Res.*, v. 36, no. 9, May, 1943.

The sub-committee of the North Central Association of Colleges and High Schools investigated the techniques of in-service education in secondary schools. Questionnaire reports requesting brief statements of the philosophy of the in-service education which gave direction to the programs of the schools were used. The results of the reports from the selected sample group show tradition and habit have tended to prevent administrators from developing techniques of more democratic procedures in the promotion of teacher-in-service growth. In-service education of the teacher is found, according to the author, "to be confused, perplexing, and in a promising state of flux."

Weber states, "Educating secondary school teachers is rapidly becoming one of the major problems of secondary school administrators."—*Helen Coleman*.

Burton, Arthur, "Behavioral Characteristics of Monotony in Two Age Groups," *Journal of Experimental Psychology*, v. 33, no. 4, Oct., 1943.

Burton's experiment was devised to compare the reactions to monotony of pre-school children and adults. Each subject was given the task of drawing 'moon-faces' "until he was fed up with it."

The characteristics of monotony were found to be similar for each group. Both groups sought substitution in the form of fantasy, whistling, etc.

Burton concludes: "Monotony occurs in the same form in young children as it does in adults, with essential differences due to maturation and development."—*Evelyn Johnston*.

House, Ralph W., "The Number of Immature Pupils Found in a Group of 176 Children," *Jl. of Ed. Res.*, v. 37, no. 3, November, 1943.

Some authorities believe that immaturity of the central nervous system, which is assumed to be one of the causes of school failures, can be indicated by body maturation. A study was made of failures in the first, second, and third grades of four towns in Eastern Kentucky. Criteria for the selection of the 176 school failures included the following: school attendance, physical defects, emotional blocks, mental ability, language spoken in home, speech handicaps, wholesome pupil-teacher-parent relationship, scholastic achievement. X-ray was used in obtaining a radiograph of the left hand and wrist. Todd's Differential Skeletal Maturation Method was used in assessing radiographs.

Thirty-six per cent of the pupils failing had skeletal ages of 10 months or more less than their chronological age.

Fifty-three per cent of the group had skeletal ages of approximately the same as the chronological ages.

Nine per cent of the group had skeletal ages ten or more months above their chronological ages.—*Helen Coleman.*

Leonard, Eugenia A., "Present Cost of Education in the Four-Year Women's Colleges," *School and Society*, 58.

The 1942 catalogues of 164 four-year women's colleges were studied relative to tuition, board and room, and required fees. (Seventy-four colleges were non-Catholic, nine were Catholic.)

The range of tuition fees was from \$50.00 to \$1,000.00 with a median of \$223.00. The range of expenses for room and board was from \$127.50 to \$1,000.00 with a median of \$455.00. Required fees ranged from \$100.00 to \$60.00. No median was made as the data were not exact.

The medians for areas for tuition and room and board are: Midwestern, \$673.00; Eastern, \$877.00; Southern, \$452.00; and Western, \$680.00. The combined median cost for the group as a whole is \$678.00.—*Carolyn Bookwalter.*

Haggard, W. W., "Some Freshmen Describe the Desirable College Teacher," *School and Society*, 58.

Mr. Haggard compares a study, made by Edna Lawson, of the qualities of a college teacher most desired by a group of seniors at the New Jersey State Teachers College with a similar study made by E. C. Upshall, who questioned 49 freshmen at the Washington College of Education.

There is substantial agreement between the New Jersey seniors and the Washington freshmen in the eight most desired qualities listed by the seniors (1) knowledge of subject, (2) personality to put course across, (3) fairness or impartiality, (4) ability or skill of teaching and organizing subject matter, (5) ability to get along with students, (6) sincerity and honesty, (7) sense of humor, (8) appearance. Three of the first eight of the freshmen list not mentioned in the senior list of eight are: (1) broadmindedness, (2) patience and helpfulness, and (3) consideration in giving assignments.—*Carolyn Bookwalter.*

Smith, Maphens, "Attitude Toward War and Capital Punishment As to Size of Community," *School and Society*, 58.

The Thurstone Attitude War Scale was administered to 651 undergraduates at the University of Kansas and the Thurstone Attitude Toward Capital Punishment Scale was administered to 585 students during the years 1932-34, and 1936-37. The subjects were students in elementary sociology classes.

The War Attitude distribution is skewed somewhat toward the higher scale values which refer to antagonism toward war. The distribution of Capital Punishment Attitude approached that of the normal curve. No significant differences were found between college students of rural and urban residence in their attitudes toward war and capital punishment.—*Carolyn Bookwalter.*

REPRINTS

from past issues of the *Research Quarterly*

10c each

- Q 294 Effects of Competitive Basketball on Physical Fitness. *Olds.*
- Q 296 Scholastic Attainment of Letter Winners. *Tuttle & Beebee.*
- Q 297 Respiratory Habits of Trained Swimmers During Starts. *Morehouse.*
- Q 298 College Hygiene Courses. *Montgomery.*
- Q 299 Evaluating Team and Individual Performance in Basketball. *Elbel & Allen.*
- Q 300 Factor Analysis of Motor Ability Variables and Tests. *Larson.*
- Q 301 Anthropometry of Young Women. *Bell, Beise, & Hughes.*
- Q 302 Measurement of Postures. *Buhl & Morrill.*
- Q 303 Relation Between Phases of Kinesthesia & Performance. *Phillipps.*
- Q 304 Qualities Used By Administrators in Judging Teachers. *Graybeal.*
- Q 305 Survey of Safety Conditions of School Buildings and Grounds. *Irwin & Stephens.*
- Q 306 Yale Freshmen Becoming Younger, Heavier, Taller. *Deegan.*
- Q 307 Anthropometric Study of Masculinity & Femininity. *Carpenter.*
- Q 308 Study of City College Physical Proficiency Test. *Ehrlich.*
- Q 309 A Study of the Post-Exercise Heart Rate. *Morehouse & Tuttle.*
- Q 310 Motor Educability Tests for Women College Students. *Hatlestad.*
- Q 311 Common Postural Defects of College Freshmen. *Wickens & Kiphuth.*
- Q 312 An Evaluation of a High School Tuberculosis Education Program. *Ross & Kinnaman.*
- Q 313 A Study of the Relationship that Exists between Skill as Measured, and the General Intelligence of College Students. *Johnson.*
- Q 314 Ophthalmic Scoliosis. *Thompson.*
- Q 318 An Evaluation of the Physical Status of City College Students on the Basis of Two Standardized Tests. *Ehrlich & Sperling.*
- Q 320 Athletes as Blood Donors. *Karpovich & Millman.*
- Q 321 Physical Education as a Profession. *Committee Report.*
- Q 322 Activities Engaged in by Teachers of Physical Education in the High Schools of Illinois. *Jackson.*
- Q 325 Body Measurements on 100 Negro Males from Tuskegee Institute. *Steggerda & Petty.*
- Q 326 Health Material in a Representative Newspaper. *Novak.*
- Q 328 The Brace Scale Used with Young Children. *Vickers, Poyntz & Baum.*
- Q 329 Motor Fitness Tests for Farm Boys. *Hall.*
- Q 330 The Importance of Providing Cumulative Sick Leave for Teachers. *Weber.*
- Q 331 A Study of Accuracy of Direction in Motor Skills at Different Distances as Determined by the Relative Size of the Angle of Error. *Moffett.*
- Q 332 Report and Recommendations of the National Committee on Aquatic Leadership. *Cureton.*
- Q 333 The Harvard Summer School of Physical Education, 1887-1932. *Van Wyck.*
- Q 334 Action Current Study of the Rectus Abdominalis as a Postural Muscle in Arm Movements. *Slater-Hammel.*
- Q 339 Relation of Selected Structural and Functional Measures to Success in College Athletics. *DiGiovanna.*
- Q 341 Improvement in Motor Fitness Associated with Physical Education and Physical Fitness Clinic Work. *Cureton.*